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ABSTRACT

Proceedings of the 1982 CAUSE national conference on information resources for college management are presented. The 41 presentations cover five subject tracks: issues in higher education, managing the information systems resource, technology and techniques, small college information systems, and innovative applications. In addition, presentations of 10 vendors, a current issues forum concerning the role of administrative computing in college-level computer literacy, an overview of CAUSE, and a keynote address are included. Some of the papers and authors include the following: "Preparing Administrators for Automated Information Technologies" (Michael M. Byrne and Stanley Kardonsky); "Overview of Campus Computing Strategies" (Carolyn P. Landis); "Legal Protection for Software" (Jon Mosser and Maureen Murphy); "Project Management:" The Key to Effective Systems Implementation" (Herbert R. Hansen, Jr.); "Personal Computers Can Help Your Budget" (Herbert W. Bomzer); "Microcomputers in Administrative Departments" (Gerry Leclerc); "Administrative Computer Systems in Small Colleges" (Robert J. Denning); "What Is Wrong with Systems Analysis" (Cecil E. Denney); "Pell Grant Tape Exchange at Carnegie-Mellon University" (Joyce A. Wineland); and "Documentation as a Management Tool" (Judith Hagen). (SW)

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CAUSE

The Information Resource: A Management Challenge

Proceedings of the 1982 CAUSE National Conference

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November 30-December 3, 1982
Hilton Head Island, South Carolina

The Information Resource: A Management Challenge

Proceedings of the
1982 CAUSE National Conference

December 1982
Hilton Head Island, South Carolina

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INTRODUCTION

Over 500 professionals involved in information systems in higher education gathered at the Hyatt on Hilton Head Island, South Carolina, November 30 to December 3, for the most successful CAUSE National Conference in the organization's history.

The CAUSE 82 theme, "The Information Resource: A Management Challenge," was addressed through 41 presentations in five subject tracks--TRACK I: Issues in Higher Education; TRACK II: Managing the Information Systems Resource; TRACK III: Technology and Techniques; TRACK IV: Small College Information Systems; and TRACK V: Innovative Applications. Conferees also had the opportunity to attend more than a dozen vendor presentations, as well as a Current Issues Forum on "The Role of Administrative Computing in Computer Literacy for Higher Education."

A special slide presentation during the CAUSE Annual Business Luncheon entitled, "CAUSE: Today and Tomorrow," provided conferees an informative and entertaining view of the association. One out of four conferees participated in the extra-curricular sports activities held in conjunction with CAUSE 82--a golf tournament, tennis round robin, and mini-marathon--and enjoyed a slide show of these events during the Thursday evening Southern Country Bash.

We hope these Proceedings will provide a continuing reference to the many activities of the Conference and the CAUSE organization. We also hope you will benefit from sharing the experiences of others and thus become more effective in the development, use, and management of information systems at your institution.

We encourage you to use CAUSE to complement your individual efforts at strengthening your organization's management capabilities through improved information systems.

CAUSE

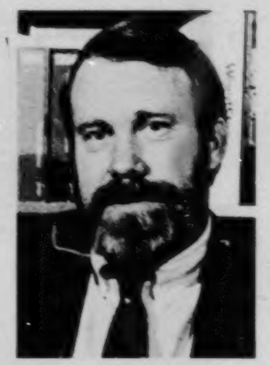
CAUSE, the Professional Association for Development, Use and Management of Information Systems in Higher Education, helps member institutions strengthen their management capabilities through improved information systems.

Formerly known as the College and University Systems Exchange, CAUSE first organized as a volunteer association in 1962 and incorporated in 1971 with 25 charter member institutions. That same year the CAUSE National Office opened in Boulder, Colorado with a professional staff to serve the membership. Today the organization has over 400 member institutions with 1,380 member representatives and continues to grow.

CAUSE provides member institutions with many services to increase the effectiveness of their administrative information systems: organization publications such as a magazine, newsletter, and monograph series, the CAUSE Directory and the Conference Proceedings; a Professional Development Program offering workshops and seminars on subjects related to information systems in higher education; consulting services to review ADP organizations and management plans; the Exchange Library to provide a clearinghouse for non-proprietary information systems contributed by members; and an Information Request Service to locate specific systems or information.

The CAUSE National Conference is an excellent forum for the exchange of ideas, systems and experiences among the many speakers and participants. The Proceedings provide a continuing reference to the many activities of the Conference.

Martin B. Solomon, Jr.
CAUSE 82 Chairman



Gary D. Devine
CAUSE 82 Vice Chairman

Charles R. Thomas
CAUSE Executive Director

ACKNOWLEDGMENTS

The success of the CAUSE National Conference is due entirely to the contributions of people and supporting organizations. Although it would be impossible to identify all of the people who contributed time and effort to the planning and operation of the 1982 Conference, several deserve special note.

The Program Committee, with the CAUSE Staff, spent many hours to produce an effective and smoothly run conference. Their enthusiasm, efforts and the support of their institutions are gratefully acknowledged.

The logistics of conference registration were efficiently supervised by Jane Knight of the CAUSE Staff with the assistance of Lynn Metcalf and Carol Waldo of the South Carolina Commission on Higher Education. Their efforts and friendly smiles are appreciated.

1982 CAUSE NATIONAL CONFERENCE PROGRAM COMMITTEE

Seated from left to right: Charles A. Brooks, Jr., South Carolina Commission on Higher Education; Deborah K. Smith, CAUSE; Martin B. Solomon, Jr., The Ohio State University; Jane Knight, CAUSE; Charles R. Thomas, CAUSE. Standing from left to right: Gary D. Devine, University of Colorado; Ray Clark, California State University; Elizabeth Little, Swarthmore College; Les Singletary, Southeastern Louisiana University; Shirley Roddenberry, State University System of Florida; Jeffrey Lazarus, Boston University; and Charles Beranek, Florida International University.

From the advance preparation for the Conference through the publication of the Proceedings, the professional expertise and efforts of Julia A. Rudy and Deborah K. Smith of the CAUSE Staff are appreciated.

A note of thanks is due to those member companies who sponsored the special events at CAUSE 82. The golf tournament sponsored by Westinghouse Information Systems, the tennis round robin sponsored by Peat, Marwick, Mitchell, & Co., and the mini-marathon sponsored by EDS provided a uniqueness to CAUSE 82 which will long be remembered.

The continuing support of the CAUSE Board of Directors and the membership they represent is also gratefully acknowledged.

1982 CAUSE BOARD OF DIRECTORS

Seated from left to right: Robert J. Sanders, Community College of Denver; Dorothy J. Hopkin, Michigan State University; Charles A. Brooks, Jr., South Carolina Commission on Higher Education; and A. Wayne Donald, Virginia Tech. Standing from left to right: William E. Walden, University of New Mexico; Charles H. Naginey, The Pennsylvania State University; Ronald J. Langley, California State University/Long Beach; James L. Strom, Clemson University; and Charles R. Thomas, CAUSE.

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GENERAL SESSIONS

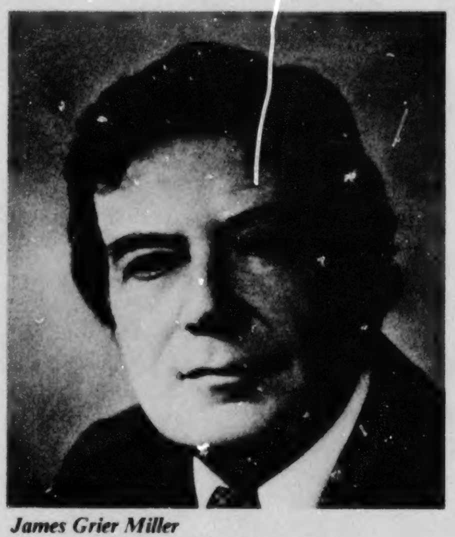
CAUSE 82 was highlighted by a number of special General Sessions which brought conferees together periodically throughout the Conference to hear presentations on subjects of broad interest and concern to all. This year the CAUSE Annual Business Meeting was held at the close of the Wednesday luncheon at CAUSE 82 and included an entertaining and informative color-graphics/slide presentation entitled, "CAUSE Today and Tomorrow." The following day, at the Third Annual CAUSE Awards Luncheon, recipients of the CAUSE Recognition Awards and *CAUSE/EFFECT* Contributor of the Year Award were honored, and awards were presented to the 1982 CAUSE National Conference Program Committee.

KEYNOTE ADDRESS

THE UNIVERSITY AS A TOTAL SYSTEM

KEYNOTE ADDRESS

Dr. James Grier Miller, President of the Robert Maynard Hutchins Center for the Study of Democratic Institutions, provided an enlightening view of "The University as a Total System." He indicated that planning, operation, and management of universities cannot be optimal unless all their diverse components are viewed as a single system. Such integration is particularly important for the design of effective management information systems.



James Grier Miller
President
Robert Maynard Hutchins Center for
the Study of Democratic Institutions

Martin B. Solomon, Jr., CAUSE 82 Chair, and Dr. Miller.

A MIDSUMMER NIGHT'S COMPUTER COMEDY

THURSDAY MORNING ADDRESS

Featured speaker Edward J. Lias, author of *FUTURE MIND,* presented what is believed to be "the world's first time-shared speech" — a spoof of time-sharing but also a serious, informative address. Presented in fast-moving toastmaster's style, the interleaved speeches cleverly combined humor, drama, and serious information to make the point that innovative computing activities may be thriving all around us, but the academic world sometimes fails to believe or accept such innovations until many years later. One speech presented scenes from the life of a brain surgeon in which certain discoveries in brain surgery were not accepted by the profession for 17 years. The other speech presented alternate strategies for economic computing which Dr. Lias believed would save big dollars for users who choose to adopt them. Supported by slides, visual aids and a telephone monologue, the address should be remembered for some time as a stimulating and conscience-probing occasion.

Edward J. Lias

CURRENT ISSUES FORUM

THE ROLE OF ADMINISTRATIVE COMPUTING IN COMPUTER LITERACY FOR HIGHER EDUCATION

Panel Moderator Jim Penrod

FRIDAY CLOSING SESSION

The Conference closed with a forum on one of the most important issues facing higher education today — computer literacy.

Panel members Richard Breslin, Robert Heterick, Daniel Updegrove, and James Penrod discussed the impact of computer literacy on the administrative computing resource. The format allowed substantial audience participation, interaction, and discussion.

Panel members, seated from left to right: Robert Heterick, Virginia Tech; James Penrod, Pepperdine University; Daniel Updegrove, EDUCOM; and Richard Breslin, Iona College.

AWARDS LUNCHEON

Program Chairman Martin B. Solomon, Jr. presented tokens of appreciation to members of the 1982 Program Committee and Registration Staff. CAUSE President Ronald J. Langley presented the third annual CAUSE Recognition Awards to Carl J. Gochenour for Professional Excellence and Joe B. Wyatt for Exemplary Leadership, and the second annual *CAUSE/EFFECT* Contributor of the Year Award to William L. Graham, W. Robert Biddington, William A. Richmond, and Reid M. Sizemore. President Langley also introduced the three new members of the CAUSE Board of Directors and the new CAUSE officers. Retiring Board member Charles A. Brooks was awarded a Certificate of Appreciation.

1983 CAUSE President James L. Strom presents outgoing President, Ronald J. Langley, the CAUSE President's Plaque.

Outgoing CAUSE President, Ronald J. Langley, presents gavel to newly-elected President James L. Strom.

New members of the CAUSE Board of Directors, from left to right: Martin B. Solomon, The Ohio State University; James I. Penrod, Pepperdine University; and John A. Monnier, University of Arizona.

Retiring Board Member, Charles A. Brooks, South Carolina Commission on Higher Education.

RECOGNITION AWARDS

President Langley presents Joe B. Wyatt the CAUSE Award for Exemplary Leadership for his advocacy and support of administrative information systems in higher education at both the university and national level.

President Langley presents Carl J. Gochenour the CAUSE Award for Professional Excellence in the field of administrative information systems in higher education at the University of Iowa and at the national level.

CAUSE/EFFECT CONTRIBUTOR OF THE YEAR

The CAUSE/EFFECT *Contributor of the Year Award was presented jointly to William L. Graham, W. Robert Biddington, William A. Richmond, and Reid M. Sizemore for their contribution to* CAUSE/EFFECT *of a feature article entitled, "ODONTICS: Omnibus Dental Online Treatment And Information Control System." Pictured above from left to right: William L. Graham, West Virginia University; Ronald J. Langley, CAUSE President; Charles D. Lamotta, Systems & Computer Technology Corporation; and W. Robert Biddington, West Virginia University.*

PROFESSIONAL PRESENTATIONS

The CAUSE 82 Conference theme, The Information Resource: A Management Challenge, was addressed through 41 presentations in five subject tracks (see Table of Contents) as well as a number of vendor presentations.

TRACK I
Issues in Higher Education

Coordinator:
Ray Clark
California State University

Robert Arns
University of Vermont

Kathlyn E. Doty
Loyola University
Chicago

INFORMATION SYSTEM REQUIREMENTS
FOR
STRATEGIC PLANNING AND STRATEGY IMPLEMENTATION

Robert G. Arns and Fred A. Curran
The University of Vermont
Burlington, Vermont

ABSTRACT: Interest in strategic planning and administration for institutions of higher education has been kindled by current economic and demographic problems. Most information systems are designed for operational purposes and stress historical, internal information whereas strategic planning requires information about a range of other variables in the external, future environment. In addition, the way in which strategy can be implemented is dependent upon organization design characteristics. Institutions of higher education are characterized by an incongruity between organizational structure and program structure that suggests the need to identify "strategic units" as a means for providing coordination across operating unit lines in implementing strategy. After strategy is implemented, the need for strategic planning continues--the energetic institution will regularly scan its environment, consider alternatives, and be responsive--but the information system now must also incorporate variables to check whether the various objectives set in strategic planning are being met. Data element definitions must contain descriptors to permit the organization and presentation of information both by operating unit and by strategic unit.

Based upon a description of information required for strategic planning and for strategy implementation, this paper will (1) present examples of applications embodying these principles, and (2) propose implications for hardware and software system requirements.

Institutions of higher education have experienced an unprecedented level of stress during the past decade. The end of the growth era, high inflation, uncertain public support, and the onset of the demographic downturn have challenged the very survival of many colleges and universities. Ways of anticipating and responding to these forces are being sought, often under the rubric of strategic planning (Cope, 1978; Groff, 1981; Kotler and Murphy, 1981). It is the purpose of this paper to examine the special nature of strategic planning and strategy implementation in colleges and universities and to derive implications for the design of information systems.

Strategy and Strategic Planning

The survival and success of an organization depend in large measure on the extent to which it looks to the future, identifies the opportunities in the turbulent world about it, and adapts its special competencies to those opportunities. In general terms, strategy is the fundamental means an organization employs to achieve a match with its environment (Hofer and Schendel, 1978, p. 23ff) or, alternatively, a pattern in a stream of actions or decisions which relate an organization to its environment (Mintzberg and Waters, 1982).

Strategic planning may be defined as the process(es) of matching the threats and opportunities of the present and future external environment with the distinctive competencies of an organization in such a way as to carve out a niche in which the organization can successfully compete and improve its performance.

Strategic planning requires an organization's leadership to come to grips with the present and future external environment of the organization and with its internal context, the internal past and present environment of the organization.

Next the organization's leadership must decide how to bring the threats and opportunities of the external environment together with internal capabilities in a way which will provide a differential advantage for the organization. This step is called strategic choice. Strategic choice is the selection, in light of the distinctive competencies of the organization, of a domain in the external environment in which to set goals. The goals are to be set in such a way as to provide a unique position for the organization vis-a-vis its competition and to enhance the efficiency of the organization by making the various goals mutually supportive (synergistic).

Four additional steps must be taken between strategic choice and implementation of the strategy. The first step is the setting of goals, desired outcomes, generally long-range and usually not expressed in measurable terms; the second step is the selection of objectives, the corresponding measurable achievements to be completed by a specific date.

One must then (third step) decide what is to be done in order to achieve the intended outcomes and how it is to be done, i.e., the activities (tasks, programs, or products) of the organization must be selected or, in an existing organization, these must be modified so that they more fully support the goals. It is at this stage of planning, in deciding how to get things done, that other implementation elements come into play. These elements, which I will refer to as structure, people, and information and decision processes, together with the activities, constitute the domain of organization design (Galbraith and Nathanson, 1978).

Finally, it is necessary to specify the resources (fourth step) required to carry out the activities previously defined, to identify the sources of these resources, and to determine the rate at which these resources can be deployed.

Completion of the plan is just the beginning. Development of the organization--building and sustaining cohesion--is an even more important part of making the organization responsive to its environment. Strategic planning most often takes place in an existing organization with an established saga and a full agenda of ongoing goals and activities. The issue then becomes one of strategic evolution, of weaning participants from accustomed routines, of opening eyes to outside forces and to the future, and of developing and focusing attention on new and changing goals.

Strategic Choice in Higher Education

We now ask whether there are special properties of colleges and universities which influence how aggressively they can anticipate and respond to environmental change. This question implies that there are limits to strategic choice in colleges and universities and that there is a range of behavior within these limits (Arns, 1982). The purpose of the inquiry is to identify the role which information systems can play in helping institutions to press the upper limit of this range. In particular, we note that few colleges and universities can anticipate overall quantitative growth; individual programs can grow and develop only if tradeoffs are made. The major algorithms for strategic choice in the profit sector emphasize growth and are inappropriate to this situation. Institutions of higher education must make conscious choices and this places a heavier burden on developing a rational basis, and the supporting information, for decision-making.

Strategic choice must also deal with the options available in the implementation of strategy. For example, the organizational structure of universities, differentiated into colleges and departments according to academic disciplines, does not match the program or goal structure; activities like "undergraduate education" and "outreach services," ordinarily involve several separate organizational units. Implementation then requires the design of coordination mechanisms and an expanded role for information and decision support systems.

When the authority relationships do not coincide with the various institutional goals and the means of attaining these goals, and when the organizational structure cannot be changed to fit the strategy, it may be useful to identify strategic units within the organization quite independently of the bureaucratic structure. Strategic units (sometimes called "strategy centers," or "natural businesses") are naturally related sets of activities each of which responds to a different mix of external environmental conditions and each of which may require a different style of administration/management (Hollowood, 1981, p. 9). Each of the strategic units sets goals consistent with the overarching goals of the organization, but the individual strategic units concentrate on different domains, i.e., on different, but overlapping, sets of environmental variables.

For the sake of illustration, suppose that there are five operating units at a particular level in a hypothetical organization and that these five operating units participate unevenly in the various goals of the organization. Assume that related goals are, in turn, grouped into five strategic units as shown in Figure 1.

Each operating unit (college, department) has an administrator who reports to the next level in the hierarchy and who administers an operating budget. The administrators of the operating units are evaluated and rewarded according to the performance of the operating unit. However, if the institution is to be attentive to its strategies and to all of its goals and if the various operating units are to work cooperatively (and efficiently) in achieving these goals, each strategic unit must also receive attention. There must be "strategy budgets" as well as "operating budgets," and evaluation and rewards must also flow along strategic lines.

Organizational Structure (operating units) → Goal Structure (strategic units) ↓	Operating Unit 1	Operating Unit 2	Operating Unit 3	Operating Unit 4	Operating Unit 5
Strategic Unit A	X	X		X	
Strategic Unit B	X	X	X	X	
Strategic Unit C				X	
Strategic Unit D			X	X	
Strategic Unit E					X

Figure 1. Representation of the relationship between the organizational structure and the goal structure at a particular level in a hypothetical complex organization. The X's in the cells indicate where the organizational structure and the goal structure intersect. For example, in this illustration Operating Unit 3 is involved in Strategic Units B and D.

The operating units might be, for example, the five colleges of a small university in which case the strategic units might be undergraduate education, graduate education, off-campus continuing education, sponsored research, and outreach services.

The mechanisms for administering these strategic units will depend upon the context of the situation, i.e., upon the anticipated difficulty of achieving goal congruence and on the degree of interdependency required for successful performance. Galbraith (1977) has identified a range of mechanisms for achieving such coordination, including spontaneous, informal contacts, group forms (task forces or committees), integrating roles (strategy managers), and matrix organization. The greater the complexity and interdependency the farther one must go down the list in order to assure coordination. However, it is wise to go no farther than required by the situation. For example, in

Figure 1, while liaison roles may suffice to coordinate Strategic Unit D, since only two operating units are involved, attention to bureaucratic relationships and collegial governance expectations may dictate an integrating role and/or a group form in order to assure coordination. Matrix organization is to be avoided unless the degree of cooperation needed is extremely high.

Information for Strategic Planning

The information needed for decision-making depends upon the kinds of decisions being made. Figure 2 illustrates the changing characteristics of the information needed as one goes from strategic planning at the one extreme; through tactical planning/management control, i.e., through those decisions involving the deployment of resources and their effective and efficient application (Anthony, 1965); to operational control at the other extreme.

The Management Information Systems (MIS) of most organizations are designed for operational control, i.e., for collecting data, processing transactions, and disseminating reports in order to record and assure performance. Such systems keep a highly accurate and detailed record of the past, organized according to the internal, bureaucratic structure of the organization. For higher education, information is typically maintained on income and expenditures, personnel, students, facilities, and programs.

The information system serving strategic planning must be capable of providing information about a wide range of other variables in the external, future environment. It must also provide tools, e.g., modeling, simulation, projection, and optimization, to aid in the delineation of alternative courses of action.

Information for Strategy Implementation

Once strategic planning moves to strategy implementation the types of decisions needed move across the spectrum of Figure 2 toward operational control. That does not mean that strategic planning information is no longer needed; the energetic institution will continue to scan its environment, consider alternatives, and be responsive. But, in addition, the information system must now incorporate variables to check whether the various objectives set in strategic planning are being met; information must be organized and displayed accordingly. Strategic choice redefines the relevant operating decisions by redefining the dominant performance measures on which operational control will be based. The operational control system evolves as strategies change.

Characteristic	Strategic Planning ↔	Tactical Planning/ Management Control ↔	Operational Control
Time Horizon	present and future	↔	past and present
Source of Information	external	↔	internal
Type of Information	qualitative	↔	quantitative
Level of Detail	aggregate	↔	detailed
Accuracy	low	↔	high
Range of Variables	wide	↔	narrow
Frequency of Use	infrequent	↔	frequent
Currency of Information	low	↔	high

Figure 2. Information Requirements by Decision Area (Gorry and Scott Morton, 1971; Burch and Strater, 1973).

For many institutions of higher education--and for other organizations that may need to distinguish between strategic units and operating units--there is yet another complexity. The traditional MIS usually organizes and distributes information along the vertical dimensions of Figure 1, i.e., by operating unit. The implementation of strategy requires that tactical planning/management control information also be organized along the horizontal dimensions of Figure 1, i.e., explicitly by strategic unit. Data element definitions must contain descriptors to permit the structuring of information both by operating unit and by strategic unit.

Operating unit administrators are concerned primarily with tactical planning/management control and with operational control decisions. Those responsible for strategic units are concerned primarily with strategic planning and with tactical planning/management control decisions.

This level of complexity is not new to large dynamic organizations. But the increasing needs for planned change and for information on which to base difficult choices may make such complexity the rule rather than the exception for many colleges and universities. Moreover, the emphasis must be placed on painless and easy evolution of information for decisions and for operational control if colleges and universities are to be responsive to changing circumstances.

Application

In order to carry out our strategic and tactical planning, it has been necessary for The University of Vermont (UVM) to develop and maintain a number of special kinds of information, including:

1. Trend Analysis, principally regarding applicants, admitted students, matriculants (each involving quantity and quality measures by college and major), full-time-equivalent students taught (by college, department, level), student to faculty ratios, and budgets. It must also be possible to rearrange the information when the organizational structure changes;
2. Cohort Analysis, in order to study retention and movement of students within the University;
3. Total Costing Analysis, in order to provide unit cost information at various levels;
4. Enrollment Projections, over a fifteen-year time span based on known demography;
5. Enrollment and Budget Simulations, combining applicant and demographic information with various curricular change assumptions;
6. Quality and Value Assessments, of programs existing and contemplated, using program evaluation processes; and
7. Market Research, involving analysis of students' reasons for selecting or not selecting UVM, student attitudes on various issues such as cost, and characteristics of competitor institutions.

Other external information, such as that pertaining to social trends and value shifts, plays an important role in strategic and tactical decisions, e.g., in the setting of enrollment targets for the various units, but is not part of the formal information system.

Implementation of the University's various strategies has been assisted by the development of a number of strategic units. For example, in July 1980, the University discontinued its School of Home Economics. Faculty and curricula were placed in four departments in two of the University's colleges, and an interdisciplinary Home Economics Program was formed in order: (1) to stimulate cooperation among the faculty in teaching, research, and service activities that transcend the individual departmental disciplines; (2) to provide opportunities for students who wish to study home economics as an interdisciplinary field; and (3) to assist in matters such as recruiting students.

The Home Economics Program is administered by a Coordinator who is advised by a faculty committee. The Coordinator is responsible for strategic and tactical planning and for operating the various activities of the Program, e.g., interdisciplinary seminars, an interdisciplinary major curriculum, student recruiting, sponsorship of events, etc.

Current performance information provided pertains to prospective and matriculating students, FTE taught, projects sponsored, and various quality and value assessments.

The information needs of our 24 strategic units are not unusual. The ease with which new information needs are fulfilled and new information reporting lines established has enabled us to keep our attention focused on long-term fundamental issues rather than becoming preoccupied with short-term details.

Implications for Information Systems

Because of the need to provide new information on short notice and to change the organization of information frequently, we have avoided "production" systems for strategic planning or tactical planning/management control applications. We have a full array of production systems for operational control. The operational data bases are of a traditional hierarchical structure. Sensitivity to strategic planning/implementation considerations at the level of the production systems has been mainly directed to issues of data element definition and to data integrity. Comprehensive, complete, and unambiguous data element definition is essential when applications cannot be defined *a priori* (Arns, 1979).

Responsibility for providing those aspects of strategic planning and tactical planning/management control information that are regularly required is assigned to our office of Budgeting and Institutional Studies, currently staffed by eight professionals. Because of problems associated with the protection of information integrity, we have not and are not prepared to decentralize to individual strategy managers responsibility for or authority over strategic planning or tactical planning/management control information.

Development of the kinds of information described in the previous section has involved the use of a number of software packages, including:

1. Course Load Matrix, an in-house software package for determining student credit hours taught, average credit hour loads, and curriculum interaction from the student and course data bases;

2. Interactive Query (IQ), a UVM general inquiry system allowing relational-like access to hierarchical data bases. Originally part of our data base management system (OASIS), the input/output routines of IQ have been modified to run under CMS on our 4341 mainframe. We use IQ to create special snapshot files from operational data bases and to answer nonrecurring questions;
3. DYNAMO, for answering questions that require dynamic modeling of complex situations;
4. FOCUS, a user friendly non-procedural application development system which operates on IBM equipment in the VM/CMS environment. With strong query and report writing capability, it allows a relatively unsophisticated user to define relationships among data from existing data bases;
5. SAS (Statistical Analysis System), which we have found to be a powerful tool for research, analysis, data and file manipulation, report generation, etc.; and, a modest amount of
6. Custom Software, written by our analysts for file merger, computational, or information presentation purposes.

Hardware capable of handling our operational systems has not suffered significant performance degradation because of the simultaneous support of strategic planning and tactical planning/management control applications.

Our production systems (i.e., for operational control) account for about 75% of CPU usage; the strategic planning and tactical planning/management control applications described account for about 3%. Of the 8 megabytes of main memory on our system, approximately 7 megabytes are available to users. FOCUS or SAS require on the order of 0.5 megabyte of main memory for each user, depending on the application. In terms of disk space, our custom software and data files for strategic and tactical planning occupy about 25 megabytes (out of a system total of about 3 gigabytes) with additional storage (e.g., of data base snapshots) on tape. The major applications software packages require additional disk storage space. For example, the essential parts of SAS require about 10 megabytes of disk storage; FOCUS takes up 5 more.

Terminal access by our analysts to all data bases and software has been essential. To date, most external environmental information has been entered locally. We look forward to the day when some of this information may be available through, for example, national library networks.

In summary, The University of Vermont is a comprehensive university deeply involved in strategic planning and actively changing strategy over time. We have experienced the need for kinds of information not previously gathered--much of it from outside of the institution, for regular evolution of the kinds of data routinely gathered, and for evolution of the ways in which those data are used. In addition we have found it necessary to regularly provide information not only to the traditional operating units (i.e., to the bureaucratic structure) but also to formal strategic units. We have found the availability of a non-procedural application development language and of a strong statistical package essential to these tasks. Hardware requirements have been compatible with the capacity required by our traditional MIS. We have not found it necessary or desirable to decentralize access to our major data bases for strategic planning or strategy implementation purposes. The current approach appears to be capable of meeting foreseeable needs.

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PREPARING ADMINISTRATORS FOR AUTOMATED INFORMATION TECHNOLOGIES

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ABSTRACT

Today's senior college and university administrator faces an ever-increasing gap between the information he (and his staff) needs to make appropriate short and long range decisions and the information he has accessible to him via traditional gathering techniques. Complicating the matter, fiscal tightening has steadily reduced the number of support personnel available to handle the growing variety of information related activities, which requires those remaining to do more than ever.

This presentation provides an analysis of the various skills the high-level administrator needs to function in this information rich-age and an outline of a method for acquiring those skills both personally and within a staff. Also, similar methods are provided for mid-level administrators responsible for gathering and managing information in an automated environment.

PREPARING ADMINISTRATORS FOR AUTOMATED INFORMATION TECHNOLOGIES

The basic tools necessary to address the issues surrounding information have existed for a number of years--administrative information systems, word processing systems, distributed processing, networking, etc. What does not exist yet, however, is any solid base of administrators with the knowledge and skills needed to select and evaluate computer hardware and software for those applications. Furthermore, these administrators now must apply similar skills to selecting hardware and software for academic applications (previously left to academic areas, but as a result of networking and distributed processing now a major administrative responsibility); for telecommunications including private telephone systems, satellite, microwave, and other forms of information transmission; for automated office systems including electronic mail, photocopiers, computer output to microfiche; and for various forms of energy monitoring and conserving devices.

Skills for Information Handling:

Before outlining the specific skills needed to work with information technologies, some general principles about information handling are necessary. The movement of information should be considered cyclical because the basic steps are usually repeated over and over again. Information seldom stops moving. In fact, when it does, it is because it is "lost" or "inaccessible," two very abnormal states for information.

Information goes through three major steps in each cycle:

1. Information is *searched for* or *acquired*.
2. Information is *sorted* into or *reduced* to meaningful portions.
3. Information is *used* (in a personal sense) or further *disseminated*.

In this Information Age, the skills administrators should possess to cope with the vast volumes of information they are now exposed to should be developed around the three steps above. The technology provides us with significant support in completing each. For example, an administrator can *search for* or *acquire* information in a number of ways, including the traditional methods they were trained to use. But some technological tools that they must learn to use to find information include doing searches on electronic data bases, receiving electronic mail, and using telephone and computer conferencing. The benefit of technology is that this step of the cycle can made more efficient, in terms of time and money, than it is using traditional search and acquire methods. Thus, administrators must incorporate these technological skills into their work worlds.

One of the most difficult and the most tedious steps in the information cycle is that of *sorting* or *reducing* information already acquired. It is this step that allows the information user to make meaning out of the jumble he has acquired by synthesizing it into meaningful portions or "piles." Yet this step is the most important one if the information is going to be able to work for us. Here information technology helps by providing major tools for that synthesization. Anyone who has used a VisiCalc type electronic spreadsheet has a sense of this power, for this type of computer software allows the user to analyze data in a myriad of ways before deciding on which method(s) to use. Electronic spreadsheets give administrators power to go way beyond the calculator (which is another tool yet unused by some administrators) to make meaning of data. Other tools for this step in the cycle include plotting and graphing packages, word processing (especially the editing features of searching, changing, cutting and pasting), and telephone and computer conferencing. Here too administrators must learn these skills to become more effective.

The final step is using or disseminating the information acquired and synthesized in the above two steps. Information technology is beginning to play a bigger role in this step. Documents are prepared using word processors or on-line computer editors and then printed, but more and more they will not be printed but sent electronically to another user to put into the beginning of his information cycle. Other information is distributed via telephone or computer conferencing, electronic mail including Telex and facsimile transmission, and microfilm or microfiche (usually for storage or infrequent reference).

What administrators should understand from the above is that they must begin to acquire the necessary skills to use the information technologies of today. These certainly include learning to use a computer for data base manipulation, electronic spreadsheets, text preparation and editing (word processing), and electronic mail. Furthermore, they cannot hope that these skills be acquired by their assistants, for today's economic trends indicate that each of us will have to do more of the work previously done by assistants. Other skills that should be acquired are implied in the outline of the information cycle above and in the practical ways to acquire those skills discussed below.

Implementation Activities

This paper is built on the following premises:

1. A structured awareness of a topic can lead to -
2. A usable base of knowledge on the topic that leads to -
3. Good decision making based on wide-ranged, informed input.

Each of the following are useful components in an overall plan to prepare members of an academic community, especially administrators, to deal with decisions related to the rapid influx of information technologies that are affecting us all. Some are designed to be ongoing activities, others used once or infrequently, and the rest used as part of a particular project implementation plan.

Mandatory Technological Literacy:

Each of us realizes information related technologies are playing a larger role in our everyday work, as well as in our homes and personal lives. To help each of us to understand better what these technologies do and how they can be best used in our work, each institution should begin to develop an on-going technological literacy program for its administrators. (Staff and faculty may be included later if it becomes desirable.) Much of the training would revolve around the computer and the many roles it plays in information exchange (Linda Ludington Seitz, Director of MIS and Educational Computing at Kalamazoo College in Michigan, has developed an excellent model for administrative computer literacy). The focus of this training would be to develop various levels of knowledge and skill within each major category of administrators. This could range from using electronic spreadsheets (VisiCalc, NCP Calc) to word processing to administrative data bases - student, personnel, physical resources. What the president and his immediate cabinet should know to use the computer well would be different from what middle management administrators should know and be able to do.

But beyond computer literacy, it is important to develop an understanding of the many other aspects of information technology. This could include private branch exchanges for telephone service

(PBX), word processing and other automated office techniques, photocopiers, computer output to microfilm/microfiche, etc. If universities are to make wise decisions regarding these technologies-either to acquire or to fully utilize-then all administrators must have a much better understanding than they now do.

The training for this literacy must be on-going, i.e., the institution must commit to a long range plan for preparing its people to manage and use these technological tools. Thus, it would be realistic to develop a three-to-five year plan that is designed to give all administrators the required literacy for their level. This could include short workshops around a particular topic, which could be given any number of times and repeated for new administrators as they come into the institution. Depending upon the degree of literacy required for each particular level, more advanced workshops should be developed, possibly each aimed at a particular level of administrators.

Any literacy program developed must be supported by all administrators, especially at the very top. If the president and the other senior administrators will not commit the time and energy necessary, then other administrators will know that it isn't important for them either. "I can always get a staff member to pick that up," is an example of that attitude. The people responsible for the final decisions must become suitably informed to make the best decision possible.

Identifying Key Personnel:

One of the most serious problems we face when making information technology related decisions is that we really do not have a very good idea who is informed on a particular topic, if anyone is. This is especially true today, because most of the formal training of current administrators hardly dealt with information technologies at all. Yet learning goes well beyond the formal training of the classroom, therefore we can assume some of our administrators have tried to become informed on their own.

By identifying ahead of time key personnel familiar with information technology, even if on a somewhat limited basis, an institution can begin to become prepared for the time when a major resource person on a particular aspect of the field may be needed. Also, once such people have been identified, some or all of them might be appointed to an ad hoc advisory committee to the president or a vice-president. They could be charged with designing and delivering the technological literacy program and other activities described in this paper. More importantly, they would be responsible for developing a base of knowledge on information technologies and be able to act as a sounding board on possible implementations.

General Technological Awareness:

In addition to formal literacy training for administrators, each institution should begin a general technological awareness campaign for all employees. The purpose of such a campaign would be to begin to reduce potential anxiety, and more importantly, resistance regarding changes that involve technology, e.g., a new telephone system, general word processing, on-line computer applications, etc. Our technology has already begun to outstrip the training of all of our staff and much of our faculty, so we really cannot expect them to accept change that is basically unknown to them.

The awareness campaign, spearheaded by the advisory committee, could include the distribution of brief articles that are very low-level yet informative, with a cover letter indicating change in that particular area (e.g., word processing) is going to probably occur sooner or later within the university and that the university leaders are concerned for all who might be involved. Feedback could be solicited, and even some short demonstrations by vendors could be arranged with the understanding that the sessions are merely informative.

A key point in such a campaign would include an effort to tie information technologies into the very lives of all of us. After all, universities are expected to be disseminators of information, and this topic provides an ideal opportunity for a university to help its people to cope with a rapidly changing world. Brief after work or noon-hour presentations could be made by informed staff or faculty on such topics as purchasing a micro-computer for the home, buying their own telephones and/or wiring the home for telephone service, etc. The benefit of such is not direct to the institution, but people who plan for information technologies in their personal world are certainly better prepared for it in their work world.

Project Coordination:

Possibly the most important step a university can take in making an informational technology change is to assign someone to be totally responsible for the project and to be the focal point of it, i.e., everyone identifies the project with that person. This coordinator should be appropriately titled and have the support of and access to the senior administrative official behind the project. The task should not be "tacked onto" an existing workload of an administrator already fully occupied with other activities. If it is, it may be difficult for him to keep up with the task and others within the university will perceive the project as not really being "that important." Implementing change is difficult enough, and implementing technological change demands a great deal of prior attention in order to bring it about effectively. Therefore, if the project is assigned to an administrator's existing workload, then it should be defined as a recognized portion of his job and formally identified as such.

The coordinator's role should include working directly with the vendor(s) providing the equipment and services of the project. To function effectively, he must learn as much as he possibly can about the technology involved in the change. He must learn the terminology, how the equipment works, what must be done when it doesn't work, etc. A major task will be to develop a realistic schedule for implementation and then hold all parties, both the vendor(s) and the university to it. The coordinator must be the only university official authorized to make changes in the plan on the university's behalf, and he must be capable and willing to bargain strongly to protect the university's interests. Unfortunately, there is often a gap between what the salesman says the technology will do and what the technicians actually are able to implement. Compromises are often sought by the vendor after the contract is signed, and the coordinator must be prepared to negotiate the most favorable solution for the university. Unless he knows the project, the terminology, and the equipment extremely well, however, he may be at the mercy of the vendors.

The second major role of the coordinator is that of public relations man. Since he will be the primary spokesman for the project, he must have very highly polished interpersonal skills. He must be patient, understanding, and willing to spend much time going over again and again the general aspects of the change with the many constituencies inherent in a university.

A less attractive alternative to assigning an internal coordinator to the project is to hire an outside consulting firm to handle the installation. Nevertheless, even with contracts containing non-collusion clauses, it is very difficult for the university to protect itself unless it has someone within the university who is very knowledgeable to handle the project.

Newsletters:

All schools are aware of the necessity for good public relations with their alumni and other outside constituents, and most now know that good "intra-university" relations are important also. A most effective method of controlling resistance to and positively shaping people's attitudes toward change is to publish a series of newsletters exclusively devoted to the project. These newsletters have four major effects:

1. They show official interest in the project on the part of senior administrators. Furthermore, the project is a "go," and there is high level concern for its success.

2. They demonstrate by their very presence a sense of organization and planning in the project and make the project coordinator known to all. They should also encourage direct communication with the coordinator, who must make himself accessible both in person and by telephone.

3. They provide the coordinator with a vehicle to respond to issues as they are raised. Thus administration appears to anticipate problems and shows an interest in a wide base for the solutions.

4. Finally, they imply continuity in the project and keep the topic current so people do not forget about it. Most importantly, the newsletters build the vocabulary of the information technology in the university by using and defining key words.

Each issue of the newsletter should focus on a different aspect of the change by effectively raising pertinent questions of individuals or groups and providing the formal answers for all readers. Early issues can provide the rationale for the change, the long-range benefits, and brief comments from senior administrators supporting the change. As the time for the change grows nearer, the topics should become less abstract and more concrete. Pictures of any equipment being acquired should be included.

Utilizing Library Resources:

One of the most overlooked resources for acquiring information about information technology is the university's own library and, especially, its staff. Most libraries assign specific staff members to become major resource people on particular topics important to members of the university. As we all know, it is very difficult to keep up with the many periodicals and professional journals in our respective fields, let alone try to read all the generally free trade journals in information technology (e.g., Computer Decisions, Telecommunications, Mini-Micro World, Computerworld, InfoWorld, The DEC Professional, which are generally meant for very will informed technologists, and those such as The Office, Modern Office Procedures, etc. for the layman). A better solution is to request the library staff to prepare a monthly list of pertinent readings on information technology compiled from the journals in the field for each group of administrators. If proper care has been taken through interview techniques, it is possible for a reference librarian to prepare only the most pertinent readings, thus saving administrators the time of sorting out the readings themselves. A second benefit is that all administrators in a similar group will receive the same readings thus assuring a common base of knowledge. This doesn't preclude anyone reading on his own, but it does make getting through all the journals more efficient.

A second valuable service most university libraries have is the capacity to access many on-line data bases. Whereas it is now standard behavior for graduate students to use such data bases for research, most administrators are as yet quite unaware of this tool, yet the payoff is almost always better information in a highly reduced time frame. Two data bases are already on-line: NTIS (National Technical Information Service), which is very rich in technical information, and DMS (Defense Marketing System), which has an incredible amount of information on high technology companies who have defense contracts. Even more applicable to universities, however, is a third on-line service. Most of us have used reports prepared by Datapro and Auerbach. Now both companies are planning on-line versions of their reports, and Datapro is scheduled to be available in a year or so. There are others, but the above give examples of what university administrators should be aware of as they prepare to work in and use information technology.

Change Tactics:

Once a university has decided to implement a technological change, it is important to broadcast widely that the change is coming. The message must come from the highest level possible of those responsible for the decision, such as a vice president. From the early stages on, the change (word processing, new telephone system, on-line data bases, etc.) must be discussed at staff meetings, even if informally at first. Very early after the decision the topic should become a standard agenda item for all major meetings of administrative staff for three reasons. It keeps the issue present in people's minds until implementation and shows the importance, it allows for formal airing of the resistance that always arises during a change, and finally it makes the change a "fact of life," not an issue.

Generally, it can be assumed that resistance to any change is a fixed quantity. Thus, the treatment to the resistance should be spread out over a greater period of time and the resistance allowed to dissipate rather than having to try to apply the majority of the treatment at the time of the change itself. Also, the staff should be encouraged to express concerns openly and in formal settings such as meetings to avoid rumors and informal resistance that may undermine the success of the project. To this end, the project coordinator should appear at as many of these meetings as is feasible to discuss how the change is coming and to address particular points of resistance.

When a change is going to be made, 1) begin early, 2) use newsletters, 3) have a coordinator, 4) provide plenty of training, and 5) stick to the plan. This last item is especially important. Once implemented, the change must look permanent. The first response of many people is to compare the change to the previous state, notice the differences, and then try to force the change to look and behave like the old state. By formally announcing that no major modifications will be made in the project plan for at least six months, it is less likely that users will be able to reduce the intended effect of the change. Furthermore, they will become conditioned to the change and will actually learn to use it in the new ways originally planned. This is not to imply that the change cannot be introduced gradually. When it can be, it should, but with some changes, it cannot or should not be done so (a new telephone system).

Conferences:

With registration and travel expenses rising, it becomes even more important to get the greatest benefit from conferences attended by university administrators. Attendees at conferences that deal with information technology and its related subjects might spend some time after the conference discussing with the ad hoc advisory committee (see above) implications for the university. Usually one important benefit of attending conferences is that new contacts are made that could be useful to the university, whether it be the computer center staff, central administrators, or others. By briefing the committee on the conference, these contacts can be shared and the information network effect of the conference greatly extended. Furthermore, administrators may begin to perceive a relationship between attending a conference and a decision that may be made later. By rotating the individuals who attend information technology conferences, each university can begin to develop the necessary base of knowledge it needs to keep up with the information explosion.

Technologies Clearing Center:

As each university becomes more and more involved in information technology, it is incumbent on administration to procure wisely. Often, it is discovered after the fact that one office uses one type of word processor while another office uses one entirely different. If word processors were all about the same, this would not make any difference, but they still are not. The net effect is duplication of training if people are moved about, inconsistency in applications, and often extra expense. One way to cope with this is to establish some office as a clearing center for all technologies. Essentially, the office would be the first contact for any vendor dealing in information technologies who wishes to sell to the university. The office would not necessarily act as the final voice on any purchases, but it could work to make sure vendors talked with the right people from the start. Furthermore, with the assistance of senior administration, it could develop a policy for consistent acquisition of all information technologies.

For example, although a university may have a number of computers, both large and small, it is not necessarily true that they can communicate with each other. Also, word processors are computers. It may be necessary that some or all of the word processors be able to access larger computers for information in order to most efficiently handle tasks such as merging student names and addresses with specialized form letters. Certainly, it would seem more practical to use existing data from an on-line student data base than to enter all the data again into a word processing system.

With a clearing center, which could be part of one person's job, the university could begin to get maximum utilization of very expensive equipment and software.

Conclusion:

The implementation of the above program would insure that each university develops the necessary wide base of knowledge about information technologies in this Information Age and begin to use the skills outlined above. The primary philosophy of the plan is that with proper planning and preparation, a university can make maximum use of its human resources at a time when skilled information technologies people for universities are hard to find. Furthermore, the costs, both in dollars and human energy, of making a mistake dictate that we become very organized and develop long range plans. It is obvious some of that long range planning must involve the types of preparation outlined in this paper.

It is difficult to see how any planned technological literacy program can succeed, however, without the support of the administrators at the very top; and yet, it is difficult to see how it could fail with their full support and cooperation. Universities are expected to show leadership in all fields. Information technologies are no exceptions, and as we implement, let us implement wisely and economically.

RETURN ON INVESTMENT - KEY TO A COMPUTING IMPROVEMENT PROGRAM

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The importance of the Return on Investment (ROI) relative to an institution's computing improvement program. These steps necessary for initiating and implementing such a program are outlined. Parts of the improvement process discussed include effective governance structures, long-range master planning, budget management, administrative versus academic priority-setting, hardware evaluation, systems development, and personnel administration. Exploration of these issues will focus on the cost-effective development of a computing improvement program.

In today's fiscally restrictive environment, colleges and universities must receive a good return on any major investment. State-of-the-art computing offers institutions of higher education enormous potential for increasing productivity while controlling costs at the same time. The key is the implementation of a computing improvement program. In order to successfully initiate this process, however, an institution must evaluate the current return on its computing investment. Let me begin by reviewing some of the points I made in my CAUSE '81 presentation on this topic.

ROI FORMULA

What is higher education receiving for its $2 billion computing investment? In measuring this aspect of ROI, it is critical to identify what it is that should be measured.

ROI ISSUE ONE: PEOPLE

The first measurement criterion is people, primarily because they represent the largest ROI formula expenditure--over $1 billion yearly. In examining staff caliber and performance, it is necessary to break down the people resource into two groups--management level and technical staff--before asking the following questions: What kind of budget success are my managers promoting? Have they developed and implemented a comprehensive Data Processing Master Plan? From a technical staff perspective, do I have sufficient depth and experience levels? Is the staff staying abreast of rapid advances in technology?

ROI ISSUE TWO: ADMINISTRATIVE SYSTEMS

Begin this assessment by focusing on the current state of administrative systems in your institutional environment. Are they fragmented, static systems, or efficient, data base applications? Are projects produced on time and within budget? How many dollars are spent yearly to maintain obsolete technology? Should you "reinvent the wheel" in-house, knowing the high cost of building new systems from scratch, or purchase already developed software applications?

ROI ISSUE THREE: HARDWARE

Evaluate your hardware from a cost/performance perspective. Have you purchased current hardware technology at today's reduced prices, or was your hardware purchased years ago under long-term financing stipulations. Some institutions are "locked in" to what is already obsolete for the next three to seven years!

ROI ISSUE FOUR: USER SATISFACTION

There is an excellent, yet easy way of evaluating this criterion. Go to your filing cabinet and compare the letters of complaint to those of commendation, relative to computing. User satisfaction is directly related to the responsiveness of Data Processing to individual requirements. If users can't get the information they need, when they need it, in a form they can understand, expect complaints to far outnumber commendations.

COMPUTING IMPROVEMENT PROGRAMS INCREASE ROI

When the four areas above have been assessed and documented, you can begin defining and implementing solutions. A computing improvement program is a viable approach to increasing ROI, but to be successful, it must become one of the highest priorities of your institution.

The process of providing computing services is expensive and requires a great deal of communication and agreement among managers, users and technical professionals. There is no substitute for a written improvement program which identifies objectives; recommends activities and projects over time, consistent with expected resources, needs of users, and other non-computing activities; and estimates resource requirements to achieve the stated objectives.

The process involves communicating, negotiating, and compromising to achieve an initial statement of objectives. It is an essential document to force the resolution of policy issues, to elicit key management decisions and to focus attention and resources towards the accepted goals. The improvement programs can and must be changed as circumstances warrant, so as not to waste resources due to indecision and the inability to properly focus them.

PURPOSES

The purposes of the computing improvement program are to:

- Establish the institution's computing service objectives;
- Document existing and future information needs and data processing requirements and resources;
- Serve as a proposal document to possible funding sources;
- Provide key managers with an understanding of their role in the systems development process;
- Describe, in detail, work activities for systems development, user coordination, and operation;
- Present priorities, schedules, milestones and costs for performing these tasks; and
- Serve as a management tool for monitoring the progress of service objectives.

TASKS

The tasks necessary to prepare the computing improvement program include the following:

- Interviews with user departments regarding their needs;
- Analysis of needs on an institution-wide basis;
- Development of alternative solutions to meet needs;
- Cost/benefit analysis;
- Development of resource requirements and budgetary strategies;
- Presentation of the computing improvement program to users; and
- Approval of the computing improvement program by users and institutional management.

COMPUTING IMPROVEMENT PROGRAM CONTENT

An outline for a computing improvement program follows:

I. MANAGEMENT AND ADMINISTRATION

  A. Management Philosophy
  B. Policy and Governance
  C. Organization
  D. Personnel Administration
  E. Planning

II. SYSTEMS DEVELOPMENT

  A. Introduction
  B. Systems Development Approach
  C. Systems Overview
  D. Operational Systems
  E. Recommended Systems

F. Proposed Development Work Plans

III. COMPUTER OPERATIONS/ENVIRONMENT

A. Introduction

B. Hardware

C. Software

D. Computer Operations Group

E. Environmental Factors

IV. RESOURCE REQUIREMENTS

A. Introduction

B. Work Plan Summary

HOW TO GET A COMPUTING IMPROVEMENT PROGRAM GOING

Begin the planning and execution of a computing improvement program by addressing the areas of:

- Data Processing Management;
- Technical Support;
- Systems and Programming;
- Operations.

The Data Processing Director and Data Processing Senior Management should then meet to discuss and ascertain:

- The depth and caliber of your Data Processing professionals;
- Budget levels, restrictions and distribution;
- The current computing master plan; and
- The governance structure.

Discussions must also be held with technical support personnel to examine:

- Depth and experience levels;
- Technical expertise and professional commitment;
- Extent of development and training activities;
- Attrition statistics and causes; and
- State-of-the-art tools available and utilized.

In the systems programming area, the following topics should be addressed:

- Current state of administrative systems;
- Degree of new development and maintenance of old systems;
- Use of integrated, data base, and on-line system approaches;
- Methodology for systems development, including the decision process to "make or buy;" and
- Degree of responsiveness to user requests.

Operations are to be reviewed on the basis of:

- Hardware utility performance and reliability;
- Financial commitments and approaches to hardware; and
- Procedures and controls employed.

Optionally, meetings may be held with key users in the areas of:

- Financial management;
- Human resources; and
- Student information.

These meetings are held to help evaluate:

- User satisfaction level;

- Degree of user computer literacy; and
- Service levels required and received.

The analysis of information gathered and the formulation of recommendations and approaches for the computing improvement program should include:

- A summary of collected findings;
- A prioritized "action plan" for the first steps of the computing improvement program; and
- Suggestions for short-term improvements, where applicable.

This evaluation must include the Data Processing Director and all appropriate Data Processing Management and staff. In addition, it is beneficial to review the importance of such topics as:

- ROI;
- User liaison approaches;
- Computer literacy training.

LONG TERM SOLUTION ENVIRONMENT

After the initiation of the "action plan" longer term computing improvement program activities should begin. These will include the following:

STEP 1:

MEET WITH STAFF

- Hold group meeting;
- Meet to explore employee suggestions for improving operating unit performance;

- Instill a sense of unity and cohesiveness in operating units, and foster a sense of service to end users;
- Impart a feeling of challenge and opportunity.

EXPLICATE PROBLEMS/REQUIREMENTS

- Define current employee duties and responsibilities and explore ways to improve these activities;
- Determine employee career goals and plans;
- Ascertain problems, personal or professional, which are barriers to employee performance.

OUTLINE SOLUTION MATRIX, PRIORITIES AND BUDGET

- Attract, retain, and provide career paths for professional growth of employees;
- Foster organizational development (structure, job descriptions, external procedures, organizational plan);
- Initiate staff development program (career counseling, staff profile, training plans).

STEP 2:

MEET WITH USER GROUPS

- Assess current levels and types of services provided to individual users;
- Review user plans which might have impact on service requirements provided by computer center;
- Determine user perceptions of current service levels and perceived problems with those service levels;
- Identify user requirements which need to be addressed.

EXPLICATE PROBLEMS/REQUIREMENTS PLUS SOLUTIONS

- Assess current status and problems;
- Plan for short term/long term improvement;
- Prioritize problem areas;
- Develop work programs with specified staff and resource requirements, objectives and outcomes to be expected.

SHORT TERM EXAMPLE

- Management improvement (development life cycle, standards, policies, procedures);
- Operations (control systems, production schedule, improved tape library, security and disaster recovery plans, utilization statistics, problem reporting systems);
- Technical Support (network crisis center, software problem reporting, utilization reporting);
- Systems and Programming (user request, fast response unit, applications specialists, procedures and standards, resystemization).

USER LIAISON

- Maintain high level of responsibility and authority in computer center for user information services and satisfaction;
- Assist in establishing priority and policy setting;
- Establish communication with user departments;
- Be prepared to troubleshoot problems;
- Keep users abreast of state-of-the-art technology;
- Train user personnel;
- Recommend improvements in manual systems and procedures;

REQUEST VOTE OF CONFIDENCE

STEP 3:

MEET WITH GOVERNANCE STRUCTURE

- Participate in policy and priority setting;
- Identify priorities, approve budgets, review status and performance;
- Participate in and guide development of computing improvement program.

EXPLICATE PROBLEMS PLUS SOLUTIONS

- Reverse the "problem set" process and begin the computing improvement program process;
- Foster awareness that a computing improvement program is not a "line item, one year program;"
- Focus on a multi-year process which requires a capital investment.

SELL COMPUTING IMPROVEMENT PROGRAM

- Recognize the changing role of data processing in higher education- be responsible for marketing and selling a service, not the ones currently provided, but rather the service wanted by the user;
- Educate the users through computer literacy programs;
- Evaluate the competency of the data processing staff;
- Be creative in developing hardware configuration and upgrade approaches;
- Assist in the process of identifying the "required budget" for the "expected service" and provide alternatives.

REAFFIRM COMPUTING AUTHORITY AND CHARTER

OVERVIEW OF CAMPUS COMPUTING STRATEGIES

by

Carolyn P. Landis

EDUCOM

Abstract

This paper reviews major elements in the planning processes and in the resulting actions and plans for technology of ten colleges and universities. Similarities and differences are highlighted. Common assumptions and common actions are noted. The ten institutions participated in an EDUCOM study of long range planning activities regarding technology on campus conducted during 1981-82. Case study institutions ranged from Hamilton College (enrollment 1600) to the 19-campus system of the California State University.

Introduction

The purpose of this paper, and of the book on which it is based, is to share campus computing planning processes and resulting plans/actions. Full case studies and an overview have been published for EDUCOM in Campus Computing Strategies by Digital Press[1]. The challenge to higher education of opportunities in converging information technologies is similar to the challenge posed by changing demographics and the shifting financial base.

During 1981-82, EDUCOM coordinated a study of 10 cases of long range planning strategies for information in colleges and universities. The studies focused not on hardware, software, and budgets but on goals, objectives & plans of the ten institutions. Criteria for inclusion in the study included demonstration of innovative, active planning to confront the information revolution; and the presence on campus of computing professionals who were willing to describe the internal strategic planning processes.

This paper and the presentation given at the CAUSE meeting were based substantially on the introduction to the book, Campus Computing Strategies, published for EDUCOM by Digital Press (Order Fulfillment, Digital Equipment Corporation, 12-A Esquire Road, Billerica, MA 01862) and on an article "Strategies for Campus Computing" by John W. McCredie published in IBM Perspectives Vol.2, No.3, October 1982.

The ten institutions participating in the study were:

California State University System
Carnegie-Mellon University
Cornell University
Dartmouth College
Hamilton College
University of Iowa
University of Minnesota
Pepperdine University
Rensselaer Polytechnic Institute
Stanford University

EDUCOM's role in the study was to bring together different approaches, viewpoints, and proposed solutions. The book attempts to answer the question "What are people planning to do about these technologies on their campuses?" Developmental work and publication of the book was funded in part by AT&T, Control Data Corporation, Digital Equipment Corporation, IBM, and Xerox Corporation.

Common Assumptions

Many of the ten case study institutions based their planning processes and their plans on the same assumptions. These assumptions are important to individuals considering initiating planning processes on other campuses. First, most of the institutions assumed that the creation, storage, retrieval, processing, use, and dissemination of information are at the core of academic effort, and computer-based information processing activities are central to this effort. The investment of significant time and effort by many individuals in the planning process is justified by the importance of information processing to the academic enterprise.

Second, virtually all of the case study institutions assumed that information processing technology is fundamentally different, particularly in the academic environment, from other technologies. The ability of computing systems to process abstract symbols enables computers to be interactive participants, rather than passive tools, in teaching and research activities. Advanced systems available today are helping scholars discover new knowledge in addition to communicating information and processing data.

Third, the academic tradition is often viewed as antagonistic to strategic planning. However, since information processing activities span several disciplines, are expensive, and have such a potentially central role in higher education, planning for them is an important institutional activity in which leading faculty and administrators must be involved.

Fourth, the costs of computer hardware capable of performing at a specified level will continue to decline during the next ten years, as they have for the last thirty, at a compound yearly rate of about 25 percent. However, institutions in higher education must be prepared to make large incremental capital investments if they are to participate in, and contribute to, the movement of the United States to an information based economy.

Fifth, regardless of their area of expertise, faculty, students, and administrators should all have opportunities to learn about the capabilities of modern information processing systems. Often college and university staff concerned with information technology, disregard one or another of these groups when planning for the use of specific resources such as text processing facilities. Most of computing professionals planning for use of information technology in the ten case study institutions, assumed that all groups, even students, should have the opportunity to learn about the capability of modern information processing systems for text processing.

Sixth, the convergence of computing and communications technologies will cause academic departments that have not had much in common in the past to work together closely in the near future. For example, libraries, computing centers, telephone offices, printing departments, audio-visual support services, and campus mail services have operated, and often continue to operate, independently. As all of these services increasingly rely upon digital equipment and communications techniques, the individuals who supervise and implement these services will have to talk to one another and work more closely than in the past. In fact, in many of the case study institutions, planners assumed that these functions would report to a single officer.

Finally, most successful uses of computing systems to date have concentrated on the processing of numeric data to support scientific and administrative activities. Since most of the work in colleges and universities deals with words and images, not numbers, the greatest future growth in computing will be the support of individuals who have not been the traditional community of computer users.

Differences in Planning Processes

Among the case study institutions, planning processes differ based on the type and length of each institution's involvement with computing: mature institutions are more evolutionary and planners strive for consensus while, in schools moving rapidly from a non-technological base to an intensive computing environment, planners generally make more drastic changes in computing and communications policies and equipment.

Planning styles also differ based on the size of institutions. In the case study group, the smaller institutions tended to display more informal planning styles, and the larger institutions were more complex and bureaucratic.

Institutional planning processes also differ as management styles differ. In the case study institutions that are characterized by direct management styles, planning processes are not necessarily direct, but they are more structured. In the case study institutions that are characterized by lazziez faire management styles, planning processes are less structured, seeming to "happen" as part of the daily operations of the college.

Similarities in Planning Processes

Some techniques for planning for computing and information technology were common to most of the case study institutions. Most of the following were used by eight or nine of the ten institutions. Although all institutions will want to vary the implementation of a specific technique to meet the demands of their environments, the following techniques might be very useful to any college or university seeking to plan for computing and information technology on campus.

Task Forces - All institutions used task forces to obtain suggestions from diverse constituencies on campus.

High level advocacy - At each case study institution, an individual or group provided a high level of advocacy for the planning process. The "high level" of advocacy in some cases meant advocacy by an officer of high rank in the administration. In other cases, the "high level" of advocacy meant a high level of enthusiasm and perseverance from the director of computing who at the time of the planning process was several levels down from the president in the administrative hierarchy.

A single administrative focalpoint for planning - Seven institutions (CMU, Cornell, Dartmouth, Stanford, Iowa, Pepperdine, CSU) established a position at the vice president/provost level for coordinating the development of information processing faculties to support instruction, research, and administration. These institutions also have computer science research departments, mature computing operations, high level administrative support.

Periods of rapid change have led to more formally structured approaches - In 1969, Pepperdine University owned one dial-up terminal and enrolled one-third the 1982 current enrollment. At the present time, Pepperdine University has a strong central computing service, a five year plan to implement an on-line decision support system, and a high level of microcomputer support for administrators. In 1974, RPI provided batch computing for academic purposes from one small central computer. By May 1977, the Board of Trustees had approved RPI's move to academic leadership in computing and information technology. Now in 1982, virtually all of RPI's 5,500 students use interactive computing routinely.

Smaller institutions have less formal planning processes - At Hamilton College, the president's cabinet is responsible for planning. There is no long range planning committee, and no "milestone" planning reports are produced. Goals are to provide high quality resources and service utilizing remote resources.

Large state universities have more formal planning processes - All of the large public (state) universities in the ten institution sample (Minnesota, Iowa, California) currently have formal planning efforts underway covering all aspects of information technology for all parts of the institutions.

Statewide system planning processes must be more complex - Only one statewide system was included in the ten institution case studies. However, from other EDUCOM activities, it is evident that the complexity in planning processes and in the implementation of those plans exhibited by the California State University system are not unique. The political processes present in multicampus statewide systems are so complex, that planning processes taking place in that environment are, of necessity, also complex. These institutions have similar goals and procedures in planning for computing to those of large public single-campus institutions. However, they must also plan with the added technical and political complications of developing networked communications among campuses with gateways to national networks.

Common Strategies

Just as they made similar assumptions, the ten case study institutions developed strategies with similar characteristics. These similarities should be of interest to others seeking to plan for computing and information technology in their institutions.

Organizational Structure - Seven of the institutions have a single administrative office or individual to coordinate information processing related issues. Of the remaining three, two are actively considering the creation of such positions.

Decentralization - All of the organizations are moving to a more decentralized information processing environment. This trend does not necessarily imply that centralized facilities will cease to exist, or even get smaller. It does mean that an increasing amount of information processing activity will occur outside of a centralized facility.

Personal Computers - All of the organizations have, or are formulating, plans related to the growing potential of personal work stations for students, scholars, and administrators. Rather than resisting the avalanche of these systems (the way many organizations resisted minicomputers in the early 1970s) the ten campuses are actively encouraging innovative uses of personal computing systems.

Networking - All ten campuses are involved with both local and national networking activities. They are investigating, and a few have installed, experimental, high capacity, digital local area networks. Some are even designing their own networks. Five of the universities have facilities connected to national packet switched networks, and all use such networks to share remote hardware and/or software resources. Several of the larger organizations are studying combined voice, digital, and video networks. Many face major investments in the telephone area, and are seeking to make such investments serve more than one purpose.

Library Automation - Once again, all of the schools have plans to deal with the convergence of computing and communications to help provide access to library resources. Many project participants are using local computer systems for circulation and serials control. Several are using national networks and resource sharing organizations for cataloging, bibliographic, and interlibrary loan services. Stanford's task force on libraries proposed a major transition: "from an emphasis on collecting and storage to an emphasis on selecting and sharing."

Information Processing Literacy - Groups or task forces in each of the colleges and universities are studying what level of literacy about computing and communications activities is required of a well-educated graduate in the 1980s. This definition will vary for each institution, but all are working on the problem.

Text Processing - In all ten institutions, text processing services are seen as important to academic computer literacy and to administrative support. In fact, text processing is the most important service that can be provided to many humanities faculty and students whose work deals with words, not numbers.

Electronic Mail - Several of the campuses have extensive electronic mail systems currently in operation, and most are actively considering how to provide this service in the future. Today these systems are used locally to allow convenient communications among faculty, students, and administrators. Many individuals are also using national computer-based mail systems to reduce travel costs and increase the effectiveness of communications for task forces.

Conclusions

Three conclusions may be drawn from a review of the similarities and differences in the planning processes and strategies developed by the ten case study institutions. First, all of these institutions are now actively planning. This characteristic is exhibited not only by the ten case study institutions, but by many EDUCOM member institutions.

Second, the planning processes in these ten case study institutions will continue beyond the current planning cycle. In fact, most of the institutions have already taken steps to incorporate the planning cycle into daily operations so that the next round of planning will be simply a part of on-going management.

Finally, planning is serious and crucial for the future for all of these institutions. Information technology is affecting the lives of all individuals employed by, and studying in, our institutions of higher education. Certainly it is important to incorporate technology into curricula and into administrative functions. Such incorporation will simply not take place without adequate planning; the institutions in the case study set recognize this, and they have taken steps to be sure that they are not left behind by the information revolution.

PUBLIC SERVICE COMPUTING: CAN IT HELP YOU?

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In these times of shrinking budgets and chronic belt tightening, most institutions can benefit from an idea that may be lying dormant on their doorstep. There is a tremendous potential for gaining resources, income, and goodwill by providing information systems support to the various "Public Services Agencies" that interface with an institution of higher education. By properly marketing the expertise of a knowledgeable staff and unused or marginal hardware resources, both the community and the institution can benefit. This paper outlines the procedures, successes, and failures of the Public Service Computing Group at Indiana University-Purdue University at Indianapolis over the past seven years.

Most institutions of higher education interact with their surrounding communities in an effort to be good neighbors and to provide service that will benefit the community and the institution as well. At Indiana University-Purdue University at Indianapolis (IUPUI) these services take many forms and service many "publics".

The use of IUPUI's atheletic facilities serves the amateur atheletics and sports medicine "publics". The campus' research and investigation capabilities can are utilized by the scientific community. The schools of Law, Business, and Public and Environmental Affairs all serve the business sector. The activities of these areas in support of the community outside the institution are all well accepted and considered to be standard practices by most universities. The benefits for the university take many forms, including goodwill, grants, matching funds, and public recognition. Most of these activities could be justified on the basis of their goodwill value alone.

If this idea of public service and community support works so well in other areas, why not provide information system support as a public service?

The idea of public service computing is not new at IUPUI. Almost seven years ago, the Computing Services Department was asked by a national medical certifying board to consider developing and operating a medical recertification data base. The idea was investigated and approval was sought to begin a large development project for a client outside the university. The approval process was long and involved but resulted in the establishment of a set of guidelines for public service computing projects.

Simply stated, the policies are that any public service computing project must be endorsed by a vice-president or academic dean as being in the public service interest of the institution. Clients are limited primarily to not-for-profit organizations such as government or social service agencies. Commercial accounts are only accepted if their need is unique and cannot be readily met by a local service bureau. The implementation guidelines for public service computing at IUPUI are very specific to our limitations, needs, and concerns. Being a state supported instituion has some impact on how services are delivered. Although the guidelines for delivery will vary, the benefits, problems, and management of a public service computing activity can be addressed in general terms, and the idea is one that can be adapted to any institution.

Of the many benefits to be gained from public service computing the first and most obvious is the positive image and goodwill that can be generated for the institution as a result of providing high quality low cost service. In the case of state supported institutions, the providing of services to other state agencies at a very low cost can allow the double use of state dollars and lower the cost of state government.

Another benefit is the opportunity to expand resources as a result of providing external services. If a client requires resources that are not currently available and is willing to pay a service fee to cover the cost of acquisition and use, the institution can then benefit from the marginal use of the equipment. For example, an institution may have a need for optical scanning equipment but not have the volume to justify the expense. If an outside client has a volume need and is willing to pay for the service, both the institution and the client benefit. This type of sitution can be used to expand the computer system, add software packages, acquire word processing equipment, or any other resource that may be needed by the public service client. The key to maximizing this benefit is to charge the client for service, not the actual purchase of an item. For example, a client may need generalized retrieval software that costs $50,000. The institution can purchase the license and charge a service fee of $50,000 for the first year and a maintenance fee thereafter. The advantage to this approach is that the institution holds the license and can use the product for any purpose it chooses even if the client should decide to abandon the original project. Remember that the usual restrictions of government grants do not necessarly apply to a given public service client.

Depending on the policies and guidelines of the institution, public service computing can be an excellent source of income. This area has to be approached carefully and should involve the legal counsel of the university.

Public Service Computing opportunities often allow the acquisition of special expertise that may not have been available before. A data base expert, statistician or other specialist can be hired for a specific project and the expertise shared throughout the organization, on a marginal basis.

The benefits of the public service computing activity are not without some problems. To be successful on a continuing basis the activity must be supported by the top administration of the institution. When the President, vice-presidents, and deans speak to community groups, it is imperative that they promote public service computing as well as the other services of the institution. The contacts made by this group of individuals combined with their level of influence on the community can mean the difference between success and failure of the public service computing activity.

The "red tape" associated with some external projects can be prohibitive. All external activities should be secured by contracts which is normally a reasonable burden, but some clients may have contract, audit, or billing requirements that make the situation unworkable. These areas should be carefully evaluated before committing to a project. The approval cycle for accepting a proposal must be as simple as possible, and the institution must be willing to provide the legal, accounting, and audit services required to support the project. All of the costs for this support can and should be figured into the fees charged to the client.

Another area that can present a problem is resource allocation. The most common approach in starting public service computing is to utilize the marginal resources available. This may mean that public service jobs are run late at night or on weekends. However, by surveying clients needs and available resources it is possible to expand gradually. Ingenuity must be a major attribute of the person responsible for securing the resources needed for a project.

When dealing with outside agencies, the need for good planning is even greater than normal. Having a plan and sticking to it is essential if you are to succeed in the public service area on a project by project basis and for the long term as well. Because of the up and down cycles that may be encountered in the public service activity, it may be necessary to plan internal "filler" projects to maintain staff productivity.

Staffing and budgeting are two areas that require very careful analysis and attention. In order to respond to new client needs, the capability for budget and staffing modifications is essential. If a new project is secured that requires three new staff members and a hundred thousand dollars worth of budget modifications, you must be able to respond quickly. The other side of the problem is what to do when a project ends or the development phase winds down. Careful planning and project balancing is critical.

The task of managing these problems is difficult but not impossible. It can be done if approached properly and if adequate institutional support is given. Once the mechanisms to approve and support projects are in place the problem becomes one of management.

Getting started in public service computing may seem like an impossible chore, but actually just a few steps are required. First, the internal support of the institution must be secured. The idea that public service computing can be valuable must be sold at the highest level in the organization. There must be a commitment to spreading the word in the community that the institution is willing and able to provide a wide variety of information systems services. There must also be a commitment to provide the budgetary and staffing flexibility required to respond to client needs. If public service computing is encouraged and supported by the top level administrators, it can be highly successful; if it is just allowed to exist, it will be doomed to a struggle for existence.

The second step is to promote the service availability to potential clients. Local governmental and United Way agencies are usually good prospects. A systematic approach to reaching these groups can yield active interest from several agencies. A brochure outlining the services available can be very helpful in getting the message to prospective clients.

The third step is to schedule the resources needed to get started. Depending on the implementation plan, the first projects should either be small and handled easily on the margin, or large enough to provide the additional resources required to support them. If it is decided to start with small projects, it will probably be necessary to juggle staff to provide support. This might be accomplished by using part-time programmers. In either case, it will be important to plan the project well to insure success.

The fourth step is to deliver a quality product. In dealing with outside clients it is extremely important to deliver on time and under budget. It is essential that the first few projects be done exceptionally well, because the best possibility for future projects will come from satisfied clients. Experience at IUPUI has shown that these agencies share information and that one good project can lead to five more.

Finally, if things go wrong, make them right. From time to time problems will arise that may require extra effort or unforeseen budgetary expense to resolve. A willingness to do what is right for the client will result in rewards greater than any expense involved.

Public service computing at IUPUI has been in operation for over seven years. It has been successful in that new resources have been acquired each year and the pool of satisfied clients continues to grow. One objective that has not been met is the goal to have a public service computing center that services the institutions needs on the margin. The momentum required to shift from running public service on the margin of other computers to running other projects on the margin of public service has not been achieved. However the institution continues to benefit from the activities of public service computing.

FINANCIAL ISSUES IN HIGER EDUCATION

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ABSTRACT

The Reagan administration's actions to reverse the 30 year trend of increasing aid to higher education have generated a voluble response on college campuses.

How serious are the budget reductions? How do they interact with the other financial issues facing colleges and universities? In an attempt to answer these questions, the author interviewed two senior university administrators to gain their views on the impending budget reductions.

Fr. Raymond C. Baumhart is President of Loyola University of Chicago, a private liberal arts institution enrolling 15,000 students. Dr. Ronald W. Brady is Executive Vice President of the University of Illinois, which has a combined student body of 60,000 on three main campuses. Neither is necessarily a "typical" university, but they represent both the private and public higher education sector with differing missions and student demographics.

This is an update of the article that appeared in the November 1982 issue of *CAUSE/EFFECT*.

On February 6, 1982 the Reagan administration added yet another note to the blues being sung on American college campuses. Throughout the 1970's educators voiced concern over the ability of the American higher education system to survive extra-inflationary costs and a declining college-age population. Spared for the moment from the projected enrollment declines, administrators carefully managed costs and emerged from the decade without a significant decline in the number of American colleges and universities.(1) Now colleges and universities find themselves attacked on the revenue side of the ledger.

Although recessionary economic conditions are strangling other sources of revenue, it is the administration's position on student aid that has generated the most controversy. The proportions of college and university revenues from various sources, including the federal government, have changed very little through the last decade, except for indirect aid in the form of federal student assistance which has grown substantially.(2) Consequently the President's request last February to cut federal student assistance programs by one-third in fiscal year 1983, following a 12% decline in 1981, elicted a new round of dire predictions from campus prophets.

Student Aid

Despite the wide-spread feeling that the growth in student aid has helped to support enrollments and influenced college choices, the precise nature of the relationship between indirect aid and university revenues is an unknown. University of Illinois Executive Vice President Ronald W. Brady explains: "I do not believe there is a direct correlation between a one dollar loss in Federal aid and a loss in students; there are no statistics to support that view." A controversial study by W. Lee Hansen found that the percentage of high school seniors expecting to complete four years of college barely changed over the period 1972 to 1980 when federal student aid quadrupled. According to the University of Wisconsin at Madison economics professor, the changes that were found cannot be directly attributed to the increased availability of financial aid.(3) Nevertheless private institutions, which tend to be more dependent on federal student aid than their public counterparts, are especially concerned about the impact of these reductions.

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(1) W. John Minter and Howard R. Bowen, "The Minter-Bowen Report, Part I", *The Chronicle of Higher Education*, May 12, 1982, p. 5.
(2) Ibid., p.6

At Loyola University of Chicago, the President's budget proposal translates to a 52% decrease in student aid between academic years 1980-81 and 1983-84. The cutbacks may not reduce revenue dollar for dollar but, as Loyola President Raymond C. Baumhart, SJ points out: "If a student decides not to go to a school because of financial aid rumors, and that student would have completed a degree, that university loses four years of revenue."

In the recent past financial aid qualification rules masked the higher costs of a private college education. As a result, the out-of-pocket cost to the student might be only a few hundred dollars more than the public university system alternative. If the cost differential increases because of the the reduced student aid, private institutions feel they will be less competitive. The National Association of Independent Colleges and Universities and National Institute of Independent Colleges and Universities (NAICU/NIICU) projects that the loss in federal student assistance funds could mean that more than 500,000 students will be priced out of a private college education in the 1983-84 school year.(4) Preliminary enrollment statistics for academic year 1982-83 indicate that these fears are already being realized; independent schools are losing enrollment to public colleges and universities. Moreover, comprehensive and Ph.D. granting schools in both categories are losing enrollments while specialized and two-year institutions are making modest gains.(5)

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(3) Janet Hook, "Increased Federal Aid Has Not attracted More Low-Income Students", *The Chronicle of Higher Education*, November 17, 1982, p. 1.

Since public institutions are much less dependent on federal student assistance, the affect of the budget reductions at the University of Illinois is much less clear. According to Executive Vice President Ronald W. Brady, "The University of Illinois turns away 6,000 students each year who apply at the Champaign-Urbana campus. Most of those students list the (University of Illinois) Circle Campus as their second choice." In fact, the University may gain students who would otherwise go out of state and those who are priced out of private institutions.

State Support

Public university systems depend on state appropriations for the majority of their revenue, not tuition. Federal cuts in block grant programs administered by the states (e.g. vocational programs, Medicaid) are disquieting, but the major concern at the state level is the nation's continuing poor economic health. Since they must compete with other public institutions and services for a share of the state budget, any loss of state revenues can be a financial threat to public universities and colleges. Twenty-four states have cut public payrolls in the last year.(6) The 6% average increase in state appropriations for higher education in 1982-83 is the smallest in more than 20 years.(7) Dramatically reduced appropriations for higher education are creating an academic exodus in Oregon and Washington.(8) In response to a 7 per cent cut in state appropriations this year, However the economically hard-hit Pacific northwest is not necessarily a harbinger for the rest of the nation; nor are past legislative attitudes towards higher education a good predictor of the states' responses to the current economic cutbacks.

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(4) Virginia Hodgkinson, "The Impact of the President's Budget Proposals Upon Students Attending Independent Colleges and Universities", Findings of the National Institute of Colleges and Universities, Washington, DC, March, 1982.

(5) Jack Magarrell, "40,962 Fewer Students Enrolled at Private Institutions This Fall", *The Chronicle of Higher Education*, November 24, 1982, p. 1 ff.

Governor Richard D. Lamm of Colorado, a state that placed 47th in appropriations per student in fiscal 1981-82, is calling for increased state aid to education as an investment in recovery. On the other hand, New York, which placed third in appropriations per student in the same time period, is being urged by Governor Hugh Carey to seek private sources for higher education funding.(9) Carey's trend towards Reagan's "New Federalism" has been echoed by other governors.

As state appropriations diminish, more state universities and colleges will have to offset their loss of revenue, at least in part, by raising tuition. Tennessee plans to raise the students' share of instructional costs by indexing tuition to the state appropriation starting with the 1982-83 academic year.(10) Higher tuition in the public university systems will help to restore the price equilibrium with private schools.

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(6) Jack Magarrell, "Falling State Revenues, Cuts in Payroll Bring Hard Times to Public Institutions", *The Chronicle of Higher Education*, February 10, 1982, p. 1.
(7) Jack Maggarrell, "Recession Hits State Support for Colleges", *The Chronicle of Higher Education*, November 20, 1982, p. 1.
(8) Barry Mitzman, "Professors, Deans, Presidents Leaving Northwest in Wake of Budget Cuts", *The Chronicle of Higher Education*, May 19, 1982, p. 8
(9) Jack Magarrell, "Falling State Revenues, Cuts in Payroll Bring Hard Times to Public Institutions", *The Chronicle of Higher Education*, February 10, 1982, p. 6.

Research

Compared to the slashes in student aid, Washington's proposal to increase basic research spending 4.4% seems generous. However, given the the administration's projected inflation rate of 6.5% this modest budget increase actually represents a loss of support for research. Moreover, the increase is not evenly allocated among all agencies. Although the Defense Department will expand basic research more than 19% in fiscal year 1983, support for science and engineering education, which plummeted 67% in fiscal year 1982, would be slashed another 34%. If, like the University of Illinois, the school has broadly diversified research activities, the affects may be minimal. According to Brady, "No single agency, department or thrust, by itself, will have much effect on research revenue at the University of Illinois."

Other Factors

As Federal and state assistance become less certain, alternative sources of revenue must be exploited to offset these reductions.

Exacerbated by inflation, the fraction of revenue provided by endowment income continued to decline in the past decade (11), though there have been exceptions. "Loyola has been doing well in increasing contributions from alumni," notes Fr. Baumhart. "We have recently added endowed chairs in departments as diverse as medicine, psychology, philosophy, theology, and business administration."

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(10) David P. Garino, "Some Colleges Try New Ways to Raise Fees", *The Wall Street Journal*, May 19, 1982, p. 1.
(11) W. John Minter and Howard R. Bowen, op. cit., p.6

The private sector is a potentially substantial revenue source which, traditionally, has not provided significant support for public colleges. Public institutions are awakening to this fact and aggressively pursuing alumni and other potential donors. In the four year period from 1974-75 to 1978-79 public universities captured a greater percentage increase in private gift and grant revenue than private universities (49 per cent versus 41 per cent).(12)

Both public and private schools are stalking another source of funds, private corporations. Carnegie-Mellon has been particularly successful in this area. Private industry now provides $9 million of its $42 million research budget, up from $4 million six years ago.(13) Unfortunately, this avenue seems limited to a small number of major research institutions, despite Washington's exhortations to business to offset the cutbacks by increasing private giving. Thomas E. Drohan, President of Foremost McKesson Inc. and a leading spokesman for corporate philanthropy, explains that businesses would have to increase their charitable contributions to 15% of pretax income, from the current 1% average, to meet the anticipated $36 billion reduction in government social service expenditures, an expectation he labels "absurd".(14)

Auxiliary enterprises will probably grow in importance as other revenues shrivel. These include the exploitation of patents, the sale of sports insignia, and the rental of meeting rooms. Major operations such as hospitals and clinics are also auxiliary enterprises. While auxiliary enterprises by definition will never approach tuition or alumni contributions as a source of revenue, they represent a series of creative opportunities, particularly for smaller institutions that have few other channels for fund raising. Appraisal of an institution's resources and effective marketing may be a real boon to smaller schools with less options. Universities may no longer be able to afford an altruistic philosophy towards institutional resources.

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(12) James Henson and Pamela S. Tolbert, *Patterns of Funding in Public and Private Higher Education*, (University of California at Los Angeles), quoted in Jack Magarrell's "Federal Cuts May Prove Especially Painful for Private Universities", *The Chronicle of Higher Education*, February 24, 1982, p.9.
(13) "Facing Cuts in Federal Grants, Big Schools Try to Get Research Work From Business", *The Wall Street Journal*, February 9, 1982, p. second front.
(14) *Dun's Business Month*, July, 1982, p. 55 ff.

Revenue Summary

Not all of the news is bad. Congress has responded to the outcries of higher education and restored some of the Reagan administration's proposed budget cuts. Democratic gains in the recent elections may make it more difficult for the administration to institute further budget reductions. The defeat of Republican Senator Harrison Schmitt of New Mexico may mean that the chairmansip of the Senate Appropriations Committee on Labor, Health and Human Services, and Education will pass to someone who is more supportive of student aid.

Since spring the Consumer Price Index has been signalling a decline in inflation, which would be very beneficial to colleges and universities. For every percentage point decline in Treasury bill rates, the government saves approximately $200 million in interest subsidies.(15) As the interest subsidies decrease, the pressure to curtail spending for higher education might also diminish. Lower interest rates would also make it practical for families to borrow to meet college tuition costs which has been a near impossibility at 21% interest.

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(15) Janet Hook, "Interest Down; Student Loans to Cost Less?", *The Chronicle of Higher Education*, November 27, 1982, p. 1 ff.

Educators' concerns are legitimate; all institutions will have to manage their resources better, but for some it will be a matter of survival. In real dollar terms, higher education will have less money than at any time in recent history. Unless a new administration reverses the tide of the "New Federalism", the generous funding that has been flowing out of Washington will slow to a trickle. Colleges and universities will have to spend more to recruit students. Public and private schools will be contending for private donations and spending more for each dollar gained. The predicted decline in enrollments has been averted because non-traditional students (women, minorities, returning workers) have supplemented the dwindling supply of 18 year-olds. As the economic environment changes, this trend may not continue. Nevertheless, a recent survey showed that college presidents, especially the presidents of private schools, are confident about the future.(16)

Recently, some schools have used endowment funds to supplement their institutional student aid. As a dramatic gesture, this centers attention on the current federal budget problem, but colleges and universities cannot endure by depleting their capital to purchase today's revenue. Nor can higher education continue to mortgage its human capital to avoid today's problems. The deferral of maintenance and replacement costs and the reduction in the real compensation of faculty and staff to meet the fiscal crises of the last decade may have lowered the resistance of many institutions in ways which do not show up on the balance sheets.(17) To increase the survival rate in the 1980's colleges and universities must find ways of responding to these problems that do not weaken the institution in the long-run. This is where data processing can make a contribution.

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(16) W. John Minter and Howard R. Bowen, "The Minter-Bowen Report, Part III", *The Chronicle of Higher Education*, May 26, 1982, p. 10.

Information Systems to the Rescue

The effective use of information systems can help to provide solutions to the financial problems facing higher education. Most colleges and universities have already implemented a basic portfolio of computer applications which automate major clerical activities such as student recordkeeping and payroll. These will continue to be important in the labor intensive higher education realm, especially since cutbacks in the Federal Work Study Program are increasing the cost of student labor, a traditional low-cost source of clerical support. But higher education must look beyond these conventional applications if it is to utilize the full potential of data processing to help meet the current fiscal crisis.

One of the reasons that colleges and universities experienced extra-inflationary costs in the past decade was their inability to improve productivity in response to rising costs. "Data processing is one of the few things around that can reduce costs in the long run. There is not much other opportunity to substitute capital for labor in the university environment", according to Brady. The substitution will not be in the classroom; CAI (computer assisted instruction) may supplement, but cannot replace, faculty. But there are many other opportunities for automation to reduce administrative costs. As an example, Dr. Brady suggests: "Source data entry at the department level could eliminate the large cost of data transcription. However, single-purpose terminals are too expensive when you consider all the costs. The marriage of data processing and word processing allows source data entry offline. This combination is incredibly exciting from a productivity standpoint."

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(17) W. John Minter and Howard R. Bowen, "The Minter-Bowen Report, Part I", *The Chronicle of Higher Education*, May 12, 1982, p. 7.

Most important of all is the potential of data processing to improve managerial productivity and effectiveness. Decision support systems can make a significant contribution to both short and long term institutional planning, particularly in times of rapid change.

Data processing can also provide the organizational flexibility to adapt to changing conditions. In response to the massive reductions in federal student assistance, the current emphasis is on flexibility in the tuition area which cannot be readily achieved without automated system support. Fr. Baumhart suggests,"Universities need to develop programs for financial aid and payment plans for those who are willing to provide a college education for their children but cannot pay all the tuition at once." Another approach is the variable rate concept, matching tuition with instructional costs.

Even though revenue problems are the current focus of concern, Dr. Brady feels that "With tight resources, tight accounting control will be critical in the long run, especially in the grant contract area." Support for the recruitment and retention of students will also be vital. Other data processing priorities may exist depending on a university's unique needs and mission. Data processing management must be sensitive to these needs and find ways to respond.

LEGAL PROTECTION FOR SOFTWARE

This panel discussion focused on the types of protection for computer programs. The source of the information was the 1980 CAUSE Monograph, LEGAL PROTECTION FOR COMPUTER PROGRAMS, by Laura Nell Gasaway and Maureen Murphy. Panel discussants were Jon Mosser and Maureen Murphy.

The types of legal protection available for computer software include copyright, patent, trade secret and unfair competition. Simple distinctions among these forms of protection are:

(1) Copyright protects the expression of an idea. The author has the rights of reproduction, adaptation and distribution. Protection is granted to the author for a period of the life of the author plus fifty years. A copyrighted work performed "for hire" is held by the employer. In this case, protection is granted for 75 years from the year of original publication or 100 years from the year of its creation, whichever expires first.

(2) Patent protection involves protection of the idea and the inventor of the idea. It grants the inventor a monopoly for 17 years to use, manufacture and sell the invention.

(3) Trade secret protection is granted at the state, not federal, level, and the definition of "trade secret" varies from state to state. As long as secrecy is maintained, the duration of protection is potentially indefinite.

(4) Unfair competition protection strives to prevent dishonesty in business dealings--to promote business integrity and fair competition. It is governed by state law, and the rules are not well-structured as in federal patent and copyright protection. This "law" protects the honest trader, punishes the dishonest trader and protects the public deception.

A discussion was held by CAUSE conference participants regarding current cases involving copyright infringement, software contract requirements, and an institution's right to protect its software development and products.

-Summary by Maureen Murphy

TRACK II
Managing the Information Systems Resource

Coordinator:
Jeffrey Lazarus
Boston University

E. Nancy Markle
Georgia Power Company

Susannah S. Ganus
University of Illinois

Dennis Berry
University of Colorado

DEVELOPMENT OF OFFICE SYSTEMS NETWORKS AS A BASE FOR SHARING ADMINISTRATIVE INFORMATION RESOURCES WITHIN UNIVERSITIES

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The parallel development of centralized, administrative data-base oriented computing facilities and networks of compatible office systems (word processing stations, intelligent printers, etc.) offers a powerful systems architecture for sharing information resources. By linking office systems technology with data processing operations within Colleges, it is feasible to improve administrative support in the areas of (1) office records management; (2) document creation and dissemination; (3) management information; (4) data processing; and (5) office communications. This paper presents the results of several studies and systems implementation efforts at Penn State that have led to this concept of resource sharing through a network architecture. A practical implementation of this concept is outlined that links the department, college, and institutional resources into a hierarchical communications network for administrative support.

INTRODUCTION

The Pennsylvania State University is a labor intensive institution. Over the past decade, Penn State's total expenditures have grown from $211.3 million in Fiscal Year 1971-72 to $478.8 million in FY 1980-81. Personnel costs (salaries, wages, and benefits) consistently average between 62-64% of these expenditures. Supporting staff (full-time non-academic employees) expanded from 6,811 in FY 71-72 to a peak of 8,495 in FY 77-78. Approximately 69% of this supporting staff are oriented primarily to information handing and processing tasks (e.g., admitting students, collecting fees, scheduling facilities, planning budgets, maintaining vital records, typing manuscripts, etc.).

The problems of providing quality information supporting services are becoming more difficult each year. In an era of tight budgets and high rates of salary inflation, the institution's ability to expand supporting staff is limited. Still, Penn State must cope with increased demands on its operations. It must, for example, respond to growing state and federal reporting and record keeping requirements; provide flexibility as the University continues to offer greater diversity in its research, instruction, and public services activities; and support the on-going growth of applicants and students who choose to come to its 22-Campus system of resident instruction.

In 1970, Penn State recognized the need to manage data as a vital resource in support of both operations and planning functions. The University embarked on a program of central administrative systems development to place institutional data into integrated data-bases and provide administrative offices (such as Payroll, Admissions, the Bursar, etc.) with on-line terminals for data entry and inquiry. High-level "user-oriented" languages and procedures were introduced to expedite the retrieval and presentation of data for ad hoc analysis and reporting efforts.*

However, there a is growing awareness that although these advances in the administrative data processing facilities are necessary, these technological advances in centralized, institutional supporting systems are insufficient to meet the administrative needs of the academic departments and college offices. Since 1979, the Office of Information and Administrative Services Coordination (IASC) has initiated a number of studies of the administrative information systems needs of Penn State's eleven Colleges and seventeen Commonwealth Campuses.[1] These studies reveal that there are significant differences between the administrative support operations of the academic offices and those of central administration. These differences affect the organization of the supporting staff and the functional requirements for their office information systems. Moreover, there are important difference between the information system requirements of the academic departments and the college offices as well as between these academic divisions and central administration.

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* In April 1982, Penn State entered into a contract with Electronic Data Systems (EDS) to accelerate and enhance the University's development of integrated data-bases and institutional data systems.

In 1980, IASC postulated an hierarchical model for an administrative support concept that was based on the emerging properties of word processing systems, tightly coupled with the communication capabilities of local area networks.[2] Recently, in cooperation with the College of Engineering, IASC and the College have completed a major investigation of their administrative information requirements and have concluded that the hierarchical model is feasible and cost effective in (1) satisfying the unique support requirements of the academic department; (2) meeting the information processing and handling needs of the College Offices; and (3) providing compatibility with the emerging institutional data systems of the University.

This paper examines the administrative information requirements of the academic departments and contrasts these needs with those of central administration. It presents the fundamental rationale underlying the model for the hierarchical administrative systems and outlines the functional design of the College of Engineering's system as one example of this concept.

GENERAL STATEMENT OF THE PROBLEM

To some extent, the present organization of the University's central administrative operating units reflect the Institution's historical solution to the growing mountain of administrative paperwork. The processing and control of University-wide information activities have been compartmentalized into organizations such as the Registrar, the Bursar, Payroll, Accounting Operations, Admissions, etc. to gain efficiency and uniformity in operations. Each unit is responsible for the University information process in its functional area. Thus, all adjustments in any employee's salary or withholdings are processed through the Payroll Office. Similarly, all changes to any student's academic record are processed through the Registrar's office.

As the University expanded in size, diversity, and scope of operations, each centralized supporting unit further subdivided its operations to more efficiently cope with the growing flow of paper forms that transmit information. The Transcript department, within the Registrar's office, was subdivided into "Graduate" and "Undergraduate" units. Later, as these office activities grew, the "Undergraduate" unit was partitioned into working groups handling "two-year" degrees and "four-year" degrees. Often, supporting staff were further organized into specialized information processing subdivisions, e.g., one group of clerks might cross-check student registrations, course drops and adds, and grade reports while another group filed, retrieved and copied paper transcripts for academic record uses.

These labor intensive information operations were ripe for the automation programs of the 1960-1970's. In many offices, concentration of personnel were performing well defined tasks on large volumes of data. It was feasible to utilize computer processing to cross-check different operational data (e.g., course registrations, drops and adds) to help isolate errors (e.g., missing grades) and update vital records. Moreover, because large volumes of similar transactions were processed at the same time, centralized, batch processing operations were cost-effective in reducing the labor requirements in these administrative offices. During this span of almost twenty-years in the maturing of central data processing, the University has developed an impressive array of forms and office procedures to collect and disseminate administrative data throughout the institution.* In the Student area alone, 40 different forms are used to collect and maintain the institutional data-bases; moreover, some 450 different computer reports, listings, and sets of mailing labels are produced from defined applications against these files.

If the Central Administrative operations were characterized by a large concentration of staff working on a limited number of well defined information tasks against large volumes of data, the operations of the academic departments can be described as being at the opposite end of this information systems spectrum. Typically, 2-4 clerical staff support the entire administrative information needs of the department. This includes handling the majority of the forms utilized by all central offices (e.g., Accounting, Payroll, Personnel, Purchasing, Registrar, etc.). These university forms, plus many additional, parochial forms and data formats, comprise the departmental office filing systems. In order to provide the Dean and department heads with up-to-date information on budgets, facilities, faculty, and students, the clerical staff maintain a number of manual files that reside in 3 x 5 cards, notebooks, and filing cabinets. These manual systems contain copies of the "official" data elements pertaining to faculty (e.g., name, address, salary), students (e.g., name, major, term standing, current registration), etc. They also contain extensions of these data to support "local" information requirements (e.g., faculty publications, committee and course assignments, areas of research interests, parking and key assignments, etc.).

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* Penn State's Forms Usage Guide, for example, defines the formal application of approximately 150 different forms within the administrative operations of the University.

> **Institutional data records, organized by social security number, student identity number, purchase order number, etc. are limited in meeting the parochial processing needs of academic departments. These data records do not reflect important college and department activities; their organization is inefficient in responding to analytical studies (e.g., how many upperdivision engineering majors come from outside the Commonwealth of Pennsylvania?).**

Although there are important differences in the information requirements between the central offices and the academic departments, another fundamental difference is their need for word processing support. The academic divisions of a University live under the guideline of "publish or perish". Faculty members create knowledge through their research efforts and disseminate this information in research papers, course offerings, and public service bulletins. The ability to publish technical materials is an important part of the academic department's support to its faculty. Unlike her clerical counterparts in many central administrative offices, the departmental secretary not only types a large number of individual letters, memos, etc., but also produces a large volume of scientific reports.

> **The word processing activities of academic departments are often unique in their requirements for handling large volumes of statistical data and mathematical/scientific notation.**

Unlike the relatively newer administrative buildings, the older ivy-covered academic buildings compound the problems of providing efficient support to faculty offices scattered throughout the colleges. Many central administrative units concentrate their clerical and professional staff within a small number of offices; mail delivery and telephone monitoring is easily accomplished in this physical arrangement. On the other hand, many colleges at Penn State have faculty members scattered throughout different floors and even across different buildings of their academic sub-divisions.

> **The delivery of administrative supporting services (e.g., mail delivery, telephone monitoring, calendar maintenance, etc.) to faculty is impeded by the physical scattering of academic offices throughout the colleges.**

The basic problem of providing administrative support in the academic departments of Penn State is that a relatively small number of clerical personnel must render a wide range of information services to support students, faculty, and the management of the department's resources. No single thrust of central administrative systems development (e.g., place the University's budget preparation efforts "on-line) can have a major impact on these wide ranging, labor intensive operations.

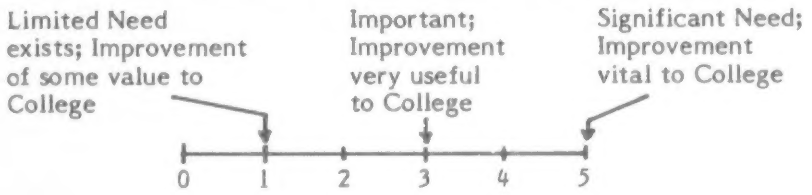
ASSESSMENT OF SPECIFIC INFORMATION REQUIREMENTS WITHIN A COLLEGE

A project team interviewed both professional and support personnel and surveyed a significant range of information tasks to assess the administrative information needs within the College of Engineering.[3] The investigation included all staff offices of the Dean and five of the ten academic departments. Although it was discovered that the specific information needs varied between these two groups, both areas could define their information requirements in six categories. Figure 1 illustrates the perceived importance of these needs, expressed by the personnel in the Dean's and departmental offices, in each information category. After interviewing key personnel, the team examined the present support operations in some detail. In brief, the survey of information support activities can be summarized as follows:

- **Document Preparation** --- a significant amount of personnel energy is devoted to typing, revision, duplication, and dissemination of textual materials from every office of the College. Approximately 32 FTE clerical personnel are devoted to these tasks each year. In the department offices, approximately 34% of this typing effort is devoted to produce technical materials, which are estimated to consume three times the effort needed over standard letters and text.
- **Management Information** --- this area has a high level of need but has no measurable amount of clerical effort devoted to its support. Examples of information requirements in this area include projecting the effects of changing enrollment demand on the resources of the College; assessing the impact of proposed academic policies on the admissions and persistence of engineering majors; etc.
- **Office Records Management** --- throughout all offices of the College, about 16% of the clerical staff efforts are devoted to the maintenance and use of office records. In addition to the University's requirements for record keeping, the College offices maintain files for their own operations. These include proposals, grants, and research reports; minutes of committees; graduate student applications, assistantships, and academic activities; faculty vitae; etc.
- **Data Processing Applications** --- presently, the College offices have some access to on-line, institutional data (e.g., Accounting, Alumni, and some student information). The departments do not have access to these data; both areas express a strong need for access to up-to-date administrative data and a capability to apply data processing applications to their information problems. Example applications include tracking student progress towards degree objectives; preparing budgets for academic

Fig. 1 - **EVALUATION OF INFORMATION REQUIREMENTS WITHIN COLLEGE OF ENGINEERING**

CATEGORY OF NEED		IMPORTANCE TO DEANS' OFFICES	IMPORTANCE TO DEPARTMENT OFFICES	OVER-ALL VALUE TO COLLEGE
1. **Document Preparation:** The creation of correspondence, documents, forms etc. for both administrative and academic purposes.	Standard	5	5	5
	Technical	1	5	5
2. **Management Information:** The analysis, planning, and decision making functions within the College. This need spans the capability to process operating data (e.g., budget status, contracts, student registrations, etc.) and resource data (personnel profiles, alumni information, course offerings, equipment inventories, etc.).		5	4	5
3. **Office Records Management:** The general storage, and usage of documents and other data maintained in office files.		4	4	4
4. **Data Processing Applications:** The execution of computer-based procedures to expedite and control administrative activities.	Institutional	5	4	5
	Local	3	3	3
5. **Office Communications:** The transfer of data ("hard" copy materials such as memos, forms, letters; as well as "soft" copy materials such as video displays) and telephone conversations among office(s) of the University.	Hard copy	2	2	2
	Soft Copy	1	1	1
6. **Office Support Operations:** The maintenance of calendars, scheduling meetings, arranging travel accommodations, etc.		2	1	1


Limited Need exists; Improvement of some value to College
Important; Improvement very useful to College
Significant Need; Improvement vital to College
0
1
2
3
4
5

SCALE OF WEIGHTS

programs and research projects; maintaining inventories and ordering supplies for laboratories; scheduling preventive maintenance efforts on equipment; scheduling College facilities for instructional and research uses; etc.

- **Office Communications** --- throughout the offices of the College, approximately 11.4 FTE in clerical staff are involved in distributing mail and using or monitoring the telephone. Although the investigations did not examine the flow of communications, it is anticipated that a major amount of this activity is between the department offices and the Dean's offices or other administrative units of the University.
- **Office Support Operations** --- very little time is seen to be devoted to the maintenance of calendars, scheduling meetings, etc.

Figure 2 summarizes the percentage of clerical time (and projected FTE) for the major information tasks of the College's administrative support operations. This survey indicates a need for improvement in the area of DOCUMENT PREPARATION. Typing, duplicating, and forms processing consume the full-time-equivalent efforts of 31.89 clerical personnel (46.3% of all supporting operations).

In a survey of over 50 word processing users at Penn State, IASC found that significant typing productivity is gained by the use of this office systems technology. The users estimated that original entry (typing) of materials was increased by an average of 40.1% and that the time for subsequent revisions was improved by 75.0% . A spot study of one word processing installation supported these reports. The measured increase in original typing was 30% and the time for revisions was improved by 70-100% (depending on the complexity of the materials) over the use of a standard office typewriter. **It must be noted, however, that because word processing systems provide a significant increase in office support, the users tend to expand the load on the secretary.** Our experience in IASC is that we have raised our standards for output documents. We now revise our draft efforts more extensively since this poses less of a burden on our secretary once she became proficient with a word processing system. The College of Engineering study team estimates that 30% of the document preparation efforts can be saved with the introduction of word processing technology. This move alone could save the equivalence of 8.73 FTE in the College's support operation.* Across all office tasks, it was estimated that the utilization of electronic-based systems could save 19.3% in all clerical operations (an FTE of 13.3). This potential savings in human resources is needed to invest in supporting operations that are not now possible within the College, i.e., improved management information and decision support services; improved support to faculty, etc.

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* It is of interest to note that the College employed an FTE of 9.0 wage payroll employees to augment the office operations of 60 full time supporting personnel in 1981.

Fig. 2 - DISTRIBUTION OF CLERICAL TIME (BOTH FULL AND PART-TIME)

CATEGORY	COLLEGE OF ENGINEERING					
	DEPARTMENTS		DEAN'S OFFICE		COLLEGE TOTALS (FTE 68.95)	
	%	FTE	%	FTE	%	FTE
Office Communications						
Mail	5.3	2.86	11.0	1.65	6.5	4.51
Telephone	9.2	4.97	12.8	1.92	10.0	6.89
	14.5%	7.83	23.8%	3.57	**16.5%**	**11.40**
Document Preparation						
Transcribing	2.1	1.13	1.8	.27	2.0	1.40
Typing	29.5	15.93	18.3	2.74	27.1	18.67
Writing	3.5	1.89	4.6	.69	3.7	2.58
Duplicating	7.1	3.83	5.3	.79	6.7	4.62
Forms Processing	5.5	2.97	11.0	1.65	6.7	4.62
	47.7%	25.75	41.0%	6.15	**46.3%**	**31.89**
Records Management						
Data Gathering	4.5	2.43	5.6	.84	4.7	3.27
Records Keeping	8.4	4.54	8.4	1.26	8.4	5.80
Filing	2.2	1.19	2.1	.31	2.1	1.50
Computer I/0	1.7	.92	--	--	1.3	.92
	16.8%	9.08	16.1%	2.41	**16.7%**	**11.49**
General Office						
Personal Meetings	10.0	5.40	6.2	.93	9.2	6.33
House Keeping	1.6	.86	1.7	.25	1.6	1.11
Organization	3.2	1.73	3.1	.46	3.2	2.19
Planning Session	2.6	1.40	2.2	.33	2.5	1.73
Attending Class	.3	.16	2.7	.40	0.8	.56
Ordering	2.5	1.35	1.1	.16	2.2	1.51
Other	.8	.43	2.1	.31	1.1	.74
	21.0%	11.33	19.1%	2.84	**20.6%**	**14.17**

The potential savings in time for faculty and academic administrators was not estimated, but is judged to be considerable. Many faculty members type and revise their own papers and perform other "clerical" tasks in the office. These activities could be off-loaded onto the supporting staff once automation removes some of the present burden.

It is also clear that, as Penn State advances its Institutional data systems, improvements in the quality and timeliness of administrative data can be achieved only by the direct entry of source data now conveyed by forms and manual procedures from the academic offices. Moving the data entry function from Central Administration to College/Campus offices will necessitate further expansion of the supporting systems in these academic units. This study of the College of Engineering was undertaken by IASC to help further formulate a model for administrative support systems development that can satisfy the administrative needs of the academic offices and link these systems with the evolving capabilities and processing requirements of the Institutional data systems. Thus, the model would allow (encourage) parallel initiatives by the colleges and Central Administration that would be compatible and synergistic.

HIERARCHICAL MODEL FOR ADMINISTRATIVE INFORMATION SYSTEMS

Technological trends continue to package significant processing and storage capabilities into desk-top computers. Within 1-2 years, a personal computer will be available with a 32-bit processor, 1-2 Mbytes of internal random access memory, and 50 Mbytes of direct access disk storage. The distinctions between word processing systems and micro-computers are disappearing. These work-stations can also access mainframe systems as interactive or remote batch terminals. User-oriented software, such as Data Manager^{TM} and VisiCalc^{TM}, provide professional users and clerical personnel with significant processing capability (without assistance from Programmers and Systems Analysts). These important trends open the opportunity for significant advances in the work-stations made available to faculty, professionals, and secretarial/clerical support personnel. Data, documents, and messages can be forwarded and stored in unattended work-stations overnight. Reasonable amounts of data can be extracted from large data bases for "on-line" analysis at the work-station, which is "off-line" from the central computer. Faculty research results can be transferred to the secretarial work-station for revisions and publishing.

Although the cost/performance curves for memory and processors remain impressive, the trends for archival storage devices, communications controllers, mechanical devices (e.g., office quality printers and sheet feeders, high speed copiers and collators), etc. are not as impressive. Moreover, these peripheral devices are not used as frequently as are the processing units, thus can be shared among a number of work-stations. Data, itself, is a vital (and expensive) resource that must often be shared within the University or college offices.

In general, the resources of an information system include data, personnel, equipment, software/processing procedures, and communication linkages. Considerations in the development and application of these resources must balance the user's requirements for function and convenience against concerns for cost-effectiveness and administrative control.

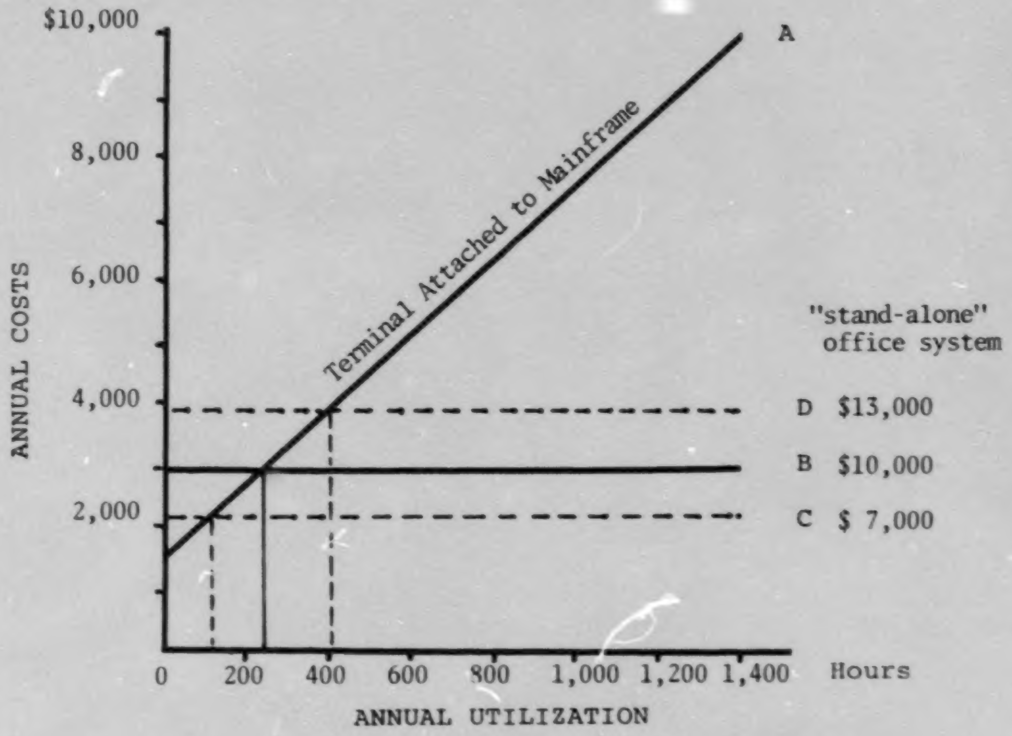
In postulating a model for the evolution of Penn State's administrative system, it is recognized that:

1. micro-computer-based work-stations can be oriented towards any of the six functional areas identified in the IASC's survey;
2. micro-computing and word processing are becoming more cost effective than mainframe computer support for certain tasks (see figure 3 for example);
3. some data and functions must be controlled along the same echelons as the University's administrative hierarchy (e.g., Institution-College-Academic Department);
4. it is not yet feasible to disperse policy and quality control over Institutional data among a network of data-bases, thus these data will remain in a central processing facility (to be both shared and protected); and
5. emerging concepts in communications and compatibility provide the means for integrating work-stations into networks that allow a user/operator to access expensive resources when needed, thus the cost per station remains low while the network expands to add new functions.

It is plausible to consider the administrative information system of the University separated into a number of processing echelons that include:

1. the user's or department office work-station;
2. a college (or regional) set of resources that are shared within this geographical area; and
3. institutional processing and data-base facilities that provide important University-wide resources and uniform services.

The relationship among these echelons must be technically close so that the end-user can access any level with ease.



Fixed Costs --- Equipment Purchased, Maintained, and Depreciated fully over five years.

A. Teleray 10M CRT terminal, Diablo Printer, 1200 baud modem

B. Lanier EZ-1, IBM Displaywriter, etc. approximately $10,000 purchase costs

C. A purchased work station for $7,000

D. A purchased work station for $13,000

Mainframe **variable costs** include:

$1.80/hour connect time
$0.21/second for estimated 17.5 seconds/hour connect time
$0.03/19Kbytes storage/day (storage estimates range between "0" at no utilization to "5 Mbytes" at 1400 hours/year usage).

Fig. 3 - Comparison Annual Costs (over five years) between Stand-Alone Word Processor and Computer-Based System

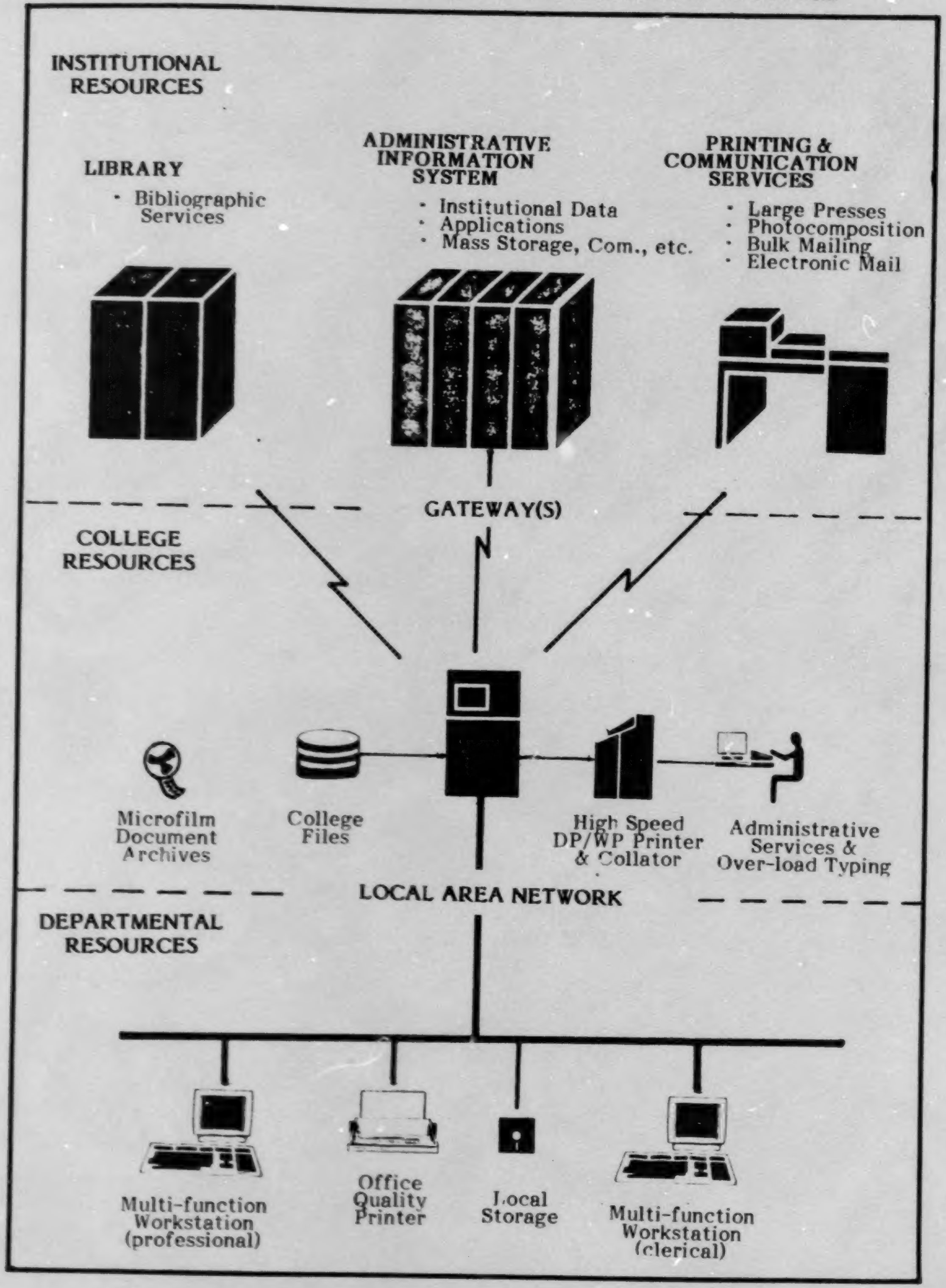
Figure 4 illustrates a proposed concept for delineating reponsibilities for the parallel development of administrative systems resources at the Pennsylvania State University. In this view, the departments can install stand-alone work-stations that provide immediate relief to their problems of word processing. The College orchestrates these compatible installations and, eventually, links these units within a local area network to provide improved services and to share resources that are too expensive to be isolated in departments that have only occasional need for these facilities. Similarly, the Institution establishes standards and develops communications transport paths to network College-department systems with the University's data systems and services. Figure 5 depicts a functional representation of the administrative support system planned for the College of Engineering. In this system, several multi-function work-stations (CRT, keyboard, processor) share an office-quality printer (with an extended-character set for mathematical and scientific notation) and a local data storage facility. Software, down-loaded from the College-level processor, provides (a) word processing, (b) local records management, and (c) low-level data processing capability. All work-stations in a department can be oriented to the same task at the same time or can be applied to support different office functions. Departmental work-stations are linked with the College facilities by a high speed communications cable. This connection supports electronic messages, mail, and document distribution throughout all offices of the College. Departmental work-stations also access and share college-level resources (e.g., data files on college personnel, curricula, VIP mailing lists; high speed printers and collating equipment; overload and specialized technical typing support; a document archive of microfilmed records; central depository of software for connected work-stations; and communications controllers and transport paths to allow office work-stations to link with Institutional facilities. Presently, Penn State is scheduling the availability of a number of electronic-based systems and services to the academic units. These include sophisticated on-line bibliographic searches of the University's subject-author-title catalogues in the Library Information Access System; integrated administrative data bases, application systems, and access to sophisticated resources (e.g., Computer Output Microfilmer, Photocomposer, Ink Jet Printer for bulk "personalized" mailings) and communication linkages across Colleges and Campuses.[4]

In examining the purchase costs for some 243 word processing systems acquired by offices of Penn State over the past five years, it was found that the average cost per stand-alone work-station rose from $8,750 in 1976 to $10,890 in 1982. The majority of these units provide only word processing capabilities. A small percentage of them support technical typing and some do support records processing. Fewer than a dozen units

Fig. 4 - MULTI-ECHELON CONCEPT FOR ADMINISTRATIVE SYSTEMS

ADMINISTRATIVE RESPONSIBILITIES	INFORMATION SYSTEM RESOURCES				
	DATA	PERSONNEL	EQUIPMENT	SOFTWARE & PROCEDURES	COMMUNICATIONS
INSTITUTION	Central, integrated data bases where all additions changes, etc. can be shared throughout the University Community. Central data systems provide a means for controlling and insuring uniformity of operations under the Policies of the University.	Central concentrations of professional expertise for the delivery of University services (e.g., Student Aid, Employee Benefits, Library, Purchasing).	Sophisticated, high performance units such as a data base processor, mass storage devices computer output microfilmer, photo-composition equipment, printing press, laser printer, etc.	University control and efficiency in applications such as Payroll, Personnel, Student, Registrations, etc.	University-wide transport paths for information flow (e.g., voice, data). This should encompass administrative data processing, electronic mail, and document distribution.
COLLEGE OR REGIONAL AREA SUCH AS A COMMONWEALTH CAMPUS	Vital records and parochial data necessary to the operations and history of the College/-Campus. May include electronic, micrographic, and paper files.	Specialized office staff (e.g., Financial officer, Personnel Representative, Alumni Relations) support for College functions.	High speed copiers, collators, quality multifont printers for technical publications, high speed printers for both data and high volume word processing.	College-level control over local facilities, personnel, activities, etc.	Local Area transport paths to share College/-Campus-based resources (e.g., clerical personnel for over-load typing) and to connect faculty members with the College's administrative services (calendar maintenance, phone monitoring, etc.).
DEPARTMENT OFFICE OR INDIVIDUAL WORK-STATION	Compatible office system provides direct support to faculty, department administrator and students. Close proximity permits professionals to off-load their "clerical" actitivy and provides human and machine entry into College and University-level systems.				

Fig. 5 - EXAMPLE OF MULTI-ECHELON ADMINISTRATIVE SYSTEM

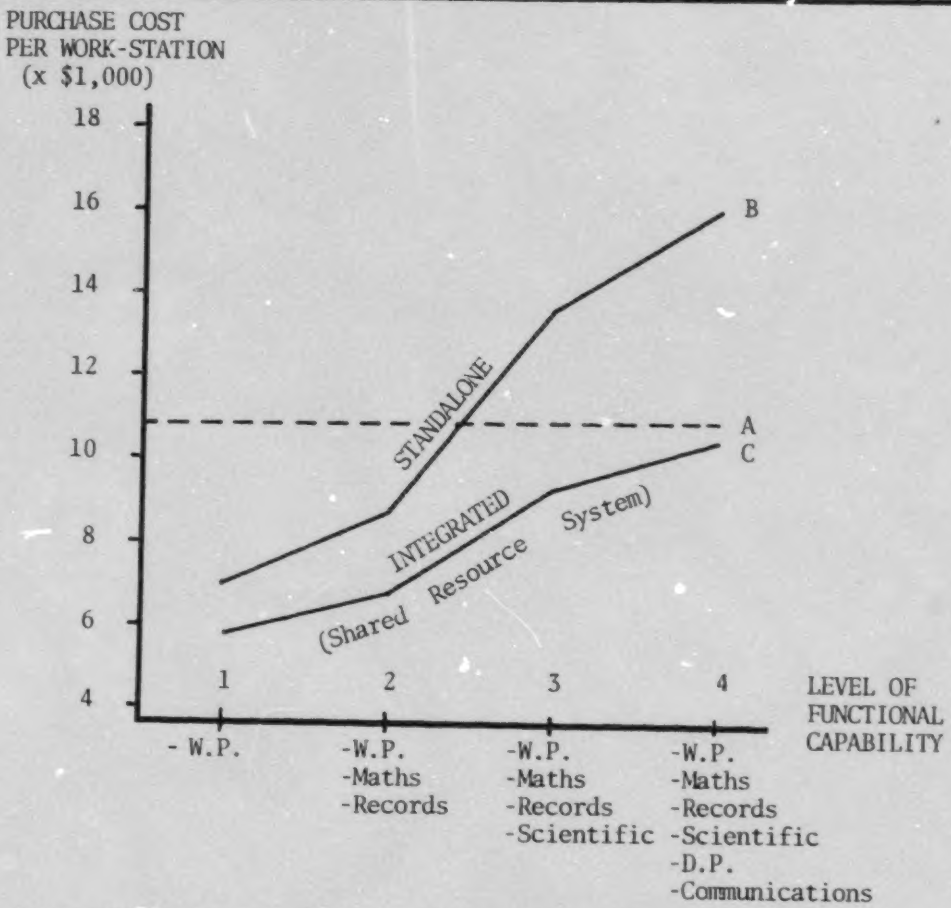

INSTITUTIONAL RESOURCES
LIBRARY
· Bibliographic Services
ADMINISTRATIVE INFORMATION SYSTEM
· Institutional Data
· Applications
· Mass Storage, Com., etc.
PRINTING & COMMUNICATION SERVICES
· Large Presses
· Photocomposition
· Bulk Mailing
· Electronic Mail
GATEWAY(S)
COLLEGE RESOURCES
Microfilm Document Archives
College Files
High Speed DP/WP Printer & Collator
Administrative Services & Over-load Typing
LOCAL AREA NETWORK
DEPARTMENTAL RESOURCES
Multi-function Workstation (professional)
Office Quality Printer
Local Storage
Multi-function Workstation (clerical)

support communications with host computers at the University. **Figure 6 illustrates that the costs of providing full multi-function capabilities within a shared resource environment is less than what is being now invested by offices seeking only word processing support.** Furthermore, by integrating these compatible office systems at the department, college, and institutional level as outlined in the proposed model, the integrated system user can achieve the desired added utility of (1) sharing workloads among personnel within the departments of the college; (2) sharing college-level resources such as data-bases, high speed printers and large on-line storage; (3) distributing the overhead costs of interfacing to the institutional facilities; and (4) being part of a managed program for the operation and development of a University-wide information system.

CONCLUSION

The information requirement and parochial processing needs of the various academic units within a University overlap the well defined set of data and procedures at the institutional level. Further development of the institutional supporting systems, though deemed necessary, is insufficient to meet the growing administrative needs of the academic departments and college offices. This paper proposed a 3-level hierarchical model for the parallel development of a University administrative system. At the lower level, the departments install standalone, yet compatible, work-stations that provide immediate relief of their problems of document preparation. At the middle level, the college/campus integrates these units within a local area network to provide improved services and to share resources that are too expensive to be isolated in individual departments. While, at the top level, the Institution establishes standards and develops communication transport paths to network the college/department systems with the University's data systems and services. Once this multi-level hierarchy of systems integration is achieved, the combined systems network becomes synergistic; able to yield something greater than the sum of its components by providing a powerful mechanism for resource sharing, increasing productivity, improving the information flow and satisfying the needs of the academic units.

The major problem is not, therefore, to increase the capital investments made in office equipment, but to focus on the manner in which these systems are acquired and integrated as part of the administrative systems planning and development efforts of the Institution. Network planning and development are difficult and require high-level professional attention and administrative focus, but the return on this investment appears to be extremely nigh for the academic units of the University.



A. Average cost per work-station purchased at Penn State in 1982 ($10,890).

B. Cost per stand-alone work-station at various levels of functional capability. At level 4 the cost includes a dedicated terminal, scientific printer, communication board, modem, telephone line and required software.

C. Cost per work-station as part of a local area network segment consisting of twenty terminals. At level 4, each two-terminal node share 256 Kbytes of internal memory, 5.6 Mbytes of on-line diskette storage, and a scientific printer. The 10 nodes are tightly coupled through a high-speed coaxial cable and a local area network controller. The intelligent controller provides additional storage of 16 Mbytes disc drive, the required software, and a communication gateway to other local area network segments and/or Institutional systems.

Fig. 6 - **Comparative Investment Costs per Work-Station between Stand-Alone Word Processor and an Integrated System.**

ENDNOTES

[1] Charles R. Blunt, Report on Administrative Information Systems Resources at the Pennsylvania State University (University Park, Pennsylvania: 1980).

William S. Adams et al., A Study of Communications, Computation, and Information Processing Needs at the Commonwealth Campuses (University Park, Pennsylvania: 1980).

[2] The Word Processor as an Integral Part of the Penn State University's Administrative Network, Ellinger and Corman, Proceedings of the ACM-SIGUCC User Services Conference IX (Atlanta, Georgia: 1981).

[3] Charles R. Blunt et al., A Study of the Administrative Information Needs Within the College of Engineering (University Park, Pennsylvania: 1982).

[4] Kamal A. Hazboun et al., Modernization of Central Files at the Pennsylvania State University (University Park, Pennsylvania: Sept. 1982).

MIS CHARGEBACK

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To strengthen the user involvement in the allocation of resources, and to help ensure that services are cost beneficial, a methodology for allocating information processing costs back to the user requesting the services has been developed. The strategy of chargeback is that it be readily accepted by the users; easy to implement, operate and maintain; and provide useful cost information in a timely, efficient manner. Only those costs that are under the direct control of the user organization are allocated.

MIS CHARGEBACK

1. "It's just bureaucratic red tape."
   "Everything has to be evaluated, documented, justified, and approved."
2. "What do you mean you are too busy to do my project?"
3. "I don't need help, I can do it myself."
4. "How much is that costing me?"
   "XYZ vendor promises to do it cheaper and faster."
5. "Don't ask me a lot of questions, just do it."
6. "I can't figure out how to track these procedures, let's automate it."
   "Help! The vendor won't listen to me, and I can't make it work."

These are comments typically addressed to the MIS organization. How can we, as MIS Management, effectively deal with these comments? How can we promote efficient, cost effective use of the information processing resources? How can we encourage resource and capacity planning? How can we meet the ever-growing information processing requirements?

MIS Management is continually seeking to provide more reliable, more responsive levels of service. Due to limited resources, the allocation of MIS information processing costs back to the requesting user will further strengthen user involvement and help ensure that services are appropriate and cost-beneficial.

MIS chargeback is defined as a procedure to identify and allocate the costs of MIS services to the end user departments that utilize those services.

While chargeback can be a significant effort, the basic philosophy and tenants of the methodology should be simple and straightforward. The purpose of this paper is to address these issues. Topics to be discussed are:

- The objectives of chargeback
- The key considerations in developing the chargeback approach
- The implementation approach at Georgia Power Company

OBJECTIVES

By charging users with the cost of MIS services, the following objectives should be met:

1. The user will be provided with a tool to monitor and control the costs of information processing. MIS personnel will be more careful to control the cost of the services provided since the user organization as well as MIS management will be reviewing and comparing the actual versus the estimated costs.
2. The existing MIS resources will be allocated based on user established priorities. The user will be more aware of the cost of his request and consequently more selective about the number and scope of those requests.
3. Planning for MIS resource and capacity requirements will be improved since the user will be required to estimate future requirements of MIS activity.
4. The process of developing the cost of a program based on MIS services will in itself provide a vehicle for improved communication between the MIS and user staffs. Both will have a better understanding of the information processing costs, and both will have a better understanding of the user requirements and the information processing cost components to meet those requirements.

KEY CONSIDERATIONS

There are a number of ways that chargeback can be implemented. The key considerations will be dictated by the objectives of charging back. If the objective is cost recovery, where all costs must be fully absorbed, then the approach will be different from an objective of solely controlling costs. Since cost control is generally a driving force behind chargeback, it will be an important ingredient in the alternatives discussed.

What Costs To Include

The first consideration is the determination of what to charge back. Only the information processing function may be considered, or the entire cost of developing and maintaining the system; that is, both information processing and user participation may be quantified. Regardless of the approach, it is important to know and identify the user resources in order to evaluate properly the cost of the system. The user organization represents a significant portion of that cost, oftentimes more than 50 percent of the total cost for system development, and an even higher maintenance proportion.

The second consideration is the allocation of costs. Where exact cost recovery is an objective, then the allocation of the full cost of service can be made to the requesting user. This is the most common approach taken to chargeback. An alternative is the allocation of direct, "controllable" costs. In this way, the user is being asked to be responsible only for the costs that he can influence and over which he can have direct control.

Many of the information processing functions benefit not only the users but also the corporation or university.

Overall programs in support of the corporation, such as strategic planning for information processing, quality assurance, or an executive advisory committee, are activities which are required regardless of the volume of a particular user's information processing activities.

Some of the costs are difficult to relate to any one particular service. For example, if the computer goes down during a payroll job, it is not the accounting department's responsibility that the computer malfunctioned, nor should accounting be charged for the job having to be rerun.

In order for a user to control his costs, it is imperative that he understand the basis of the cost and that he be given the opportunity to modify those costs.

Which Costing Methodology

Many chargeback systems use a methodology of adding all the actual costs dividing the total by the number of users to derive the unit cost. With this methodology, all actual costs will be absorbed. However, the unit cost will fluctuate depending on actual expenses and volume of use. The user has no control over actual expenses and while he may have control over his own volume, he has no control over the total volume of use. With this methodology he is a victim of circumstances making budgeting an ambiguous process.

All the actual costs can be charged at each time period, or a standard rate can be charged. With a standard rate a fixed price is set for an activity or product. While a standard rate is more difficult and risky for the MIS organization in that there is strong propensity for over or under absorption of actual costs, it is a much simpler methodology for the user. A standard rate allows the user to plan better for his charges.

The user's charges will be specifically influenced by his consumption. If, for example, a user were being charged five cents for each invoice processed, then the volume of his invoices would determine his charges. This is an environment with which he is familiar and over which he can exert control. Furthermore, a standard rate provides a measure of the efficiency of the information processing function. Deviation from the budget immediately points up a change in plans, and it is easier to monitor actual against budget when the pricing for service is clearly understood.

Most importantly, the user will be able to determine more readily the cost benefits of the alternative products and services. He will be able to make more knowledgeable decisions about which of the information processing solutions would be best for his organization or even whether an information processing solution is in his best interest. Conversely the information processing organization is in a position to price products and services in such a way as to encourage or discourage their use. Assume for example a page printer has just been purchased, and MIS would like to phase out the old impact printer. Reducing the price of a page-printed report would encourage the user community to make the change.

How Much Integration

The degree of integration with the total planning, budgeting and controlling process of the company is both a function of the objectives of MIS chargeback as well as the stage of implementation. Stand alone memo accounting may be the only integration desirable or it may be the first step toward total integration. A stand alone memo function is the capturing of MIS costs and identification of those costs to the requesting user. With this process, the user is made aware of what his information processing charges are though he is not held accountable for those costs. When chargeback is a part of the overall planning and budgeting process, the user is held responsible for his information processing costs. He is responsible not only for the costs of production, but for the identification and quantification of future requirements. It is he who must get management support for the programs he desires and approval for the cost of those programs. Information processing costs are a part of the operational cost of doing business. As such it is appropriate for the user budget to reflect that cost, and consequently reflect the actual cost of the user function.

One of the important advantages of complete integration with the planning and budgeting process is enhanced communication with the user function. Too often the MIS organization is perceived as restrictive bureaucratic hurdle. By putting the decision-making for information processing in the hands of the user community, where the user must convince his management that the cost is beneficial to the enterprise, MIS is in a position to change the perception of its role. The MIS function can be one of providing a service and helping to support the user in the planning process. MIS will provide alternatives, cost estimates, and assist in developing cost benefit analysis. Restricting information processing costs will come from user management because of an unwillingness to bear the cost of an Information processing solution. It will not come as a result of constrained MIS resources.

As the price of information processing equipment decreases, interestingly enough the overall corporate investment in information processing is increasing. The obvious reason is that with increasing labor costs and decreasing computer costs, it is wise to turn to computers for business assistance. As more and more individual functions turn to computer solutions, the sum total of data processing costs to the enterprise is increasing. When the data processing costs are fully integrated with the planning, budgeting, and controlling systems, it becomes readily apparent that the increase in costs are due to increase in utilization; these costs are reflective of a summarization of individual data processing applications. Furthermore, anticipation of the increasing growth provides enhanced strategy and capacity planning for the MIS organization and provides the senior management of the enterprise with an awareness of expected growth and accompanying requirements. Where this growth is undesirable, it will be the management of the enterprise who will be in position to control proliferation.

IMPLEMENTATION STATUS

At Georgia Power Company the primary objective of the chargeback project is cost control. For this reason, the project has been renamed Information Processing Cost Control System. A good cost accounting system is essential for any type of chargeback or cost control.

The first step in a cost control process is the accurate and timely reporting of costs currently budgeted and being incurred. This step includes the establishment of a procedure for communicating changes, revisions, exceptions, and modifications to information processing activities. This includes the development of a system to accumulate and report controllable cost components by project as well as all budget variances by controllable cost component and by project. The reporting scheme is an interim measure to gain experience with the cost of data processing and to establish a level of detail. This is important for two reasons: first, in order to have a basic understanding of what costs will be needed for budgeting by the user area; and second, to form the basis for the allocation of costs to the various users. Cost accounting requires that the costs be based on a volume of work activity; for example, the time required and the key strokes for entering and verifying data for a system. The cost accounting system will provide the actual cost of doing a specific volume of activity.

The next step is to convert costs into a pricing mechanism that will be readily understandable and controllable by the user community. This pricing mechanism must be integrated into the total planning, budgeting, and controlling process. At Georgia Power Company, the planning, budgeting, and controlling process is called the Integrated Management System. Chargeback or cost control is being implemented as a part of that system.

The following discussion addresses the merging of chargeback into the total planning, budgeting, and controlling process. The Integrated Management System begins with the planning phase where corporate objectives are established, and a dialogue between senior management and the staff leads to the setting of goals and objectives. The goals and objectives are translated into action programs which include the identification of information processing systems and their associated resource requirements. For example, assume that you are the appliance service department and you want a system to keep track of how many service calls are made by category of appliance. You will work with the MIS department to define the overall scope of your desired system and develop anticipated volumes and associated costs. Your management, that is the management of appliance services, will approve or disapprove the allocation of those costs for your desired system. If those costs are approved, and the costs are also approved by senior management in the aggregate, then they become part of the basis for the information processing budget. It will also provide the resource requirements of the MIS function. The costs themselves will be included in each requesting user budget so appliance services would have a cost for their system in their budget. As a system is developed, implemented and put into production, the charges flow into both the MIS budget and the requesting user budget. Indirect information processing costs such as computer reruns are monitored by the MIS organization as well as the MIS Executive Steering Committee. This committee is composed of the senior executives of the user functional/administrative areas.

Both MIS and the users monitor the costs of each system. This provides a strong incentive to reduce costs. The pressure is on the user by his management to keep control of his information processing costs and to ensure the benefits of each activity. The pressure is on the MIS organization to provide the most efficient and effective service. When the user knows the price, he can make an intelligent decision as to whether the system, or part of the system is cost beneficial. He can also work closely with the MIS organization to reduce or eliminate unimportant activities and reports.

At least annually the MIS organization reviews the allocation rates to ensure that over an extended period of time the amounts being charged closely equal the controllable costs of the MIS organization. An Appliance Service System was used as an example to illustrate the importance of integrating chargeback into a total budgetary system. In Georgia Power Company several years ago it was determined that appliance service was costing the company money which it was not recovering. Senior management began to take steps to phase out this function. Without the integration of planning and budgeting with the information processing function, it is conceivable that this project would have been undertaken and the resources allocated to it totally wasted.

By developing chargeback systems which make sense to the user, which are understandable, controllable, and consistent with the user's environment, the user is in a position to minimize his costs and, more importantly for the MIS organization, to substantiate his portion of the overall increasing data processing costs of the enterprise.

MANAGEMENT TIPS FOR OFFICE AUTOMATION

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ABSTRACT: The professional experiences of the speakers and those gained at the University of Maryland and the University of Illinois are used to provide users with directions in working their way through the office automation maze of new technology and this immature "discipline."

It's Not Likely to Get Better Soon

Today we have about a decade of experience in word processing behind us since the time in the early 1970's when Lexitron set the standard for our present-day systems. Now we must be concerned with technologies beyond word processing. The pieces of the office automation puzzle include electronic filing, word processing, micrographics, data processing, data entry, reprographics, electronic mail, decision support, calendaring and scheduling, and are based on workstations which serve as both autonomous personal computers and on-line terminals. Office automation is now closer to data processing than to word processing, but it continues to focus on the interactive needs of an office, and is characterized by a heavy emphasis on human factors.

The proliferation of office automation products and the pace of technology have left the average manager's mind in shambles as he tries to develop a plan for coordinated office systems. Recognizing that few managers have the time to become expert in all the functional areas of the office, this paper is designed to take one heroic step to fill that void. Failing this, or adopting Andrew Jackson's Civil War philosophy, "We'd better elevate those sights a little lower," it is believed that the manager will become more aware of the scope of office automation and be alert to the more obvious pitfalls.

Office automation is not a product, or a set of equipment and software, but an attitude, a commitment to a new way of thinking about the office and its processes. It is dynamic and ongoing, a continued re-evaluation process which governs the cost-effective and productive use of human resources and equipment.

What's A Manager to Do About Office Automation?

"It's a jungle out there!" is the cliche in the OA seminar circuit. One is overwhelmed by over 160 models of word processors alone, offered by 60 vendors. From A. B. Dick to Xerox, you can select the color, size, and shape to suit your heart's desire. How can one approach the problem? We suggest you ask these questions:

1. How committed is this vendor to office automation as a total system?
2. What pieces of the OA puzzle are present and which are missing?
3. How good are the current OA products in comparison to the market?
4. How does the company compare to the competition?
5. Does the system offer a good foundation on which to build an organization-wide OA system?
6. What does the system look and feel like? Are the office people going to accept it into their environment?
7. What are the strengths and weaknesses of the system?
8. Who are the intended buyers? Who has had success with it already? Are these users in a similar situation to yours?

The 80/80 Theorem holds: In today's word processing industry about 80% of the boxes will do 80% of what you will need. Features common to all the major word processing systems:

- word wraparound
- automatic centering
- automatic headers and footers
- global search and replace
- automatic decimal alignment

- block move, copy and delete
- arithmetic calculation
- paragraph assembly
- simultaneous input of one document while printing another
- pagination and repagination
- list processing and merge
- columnar move, copy, and delete
- access to other documents

In spite of the similarities, what you will find is that the salesman who darkens your door wants you to focus on the one or two features which distinguish his system from all others. Don't let him get away with it! Focus on a feature only if your user has demonstrated it is critical to the operation, such as a spelling checker for a publications area, or massive storage and paragraph reassembly in a public affairs area.

But we are talking only about equipment selection, one of the easiest parts of the problem. What about the other aspects of planning faced with a marketplace already crowded with multiple vendor offerings? Does your campus have eighteen different kinds of word processors, ten types of personal computers, and twenty types of mini-computers, and yet want them all tied together into a shared-resource system which hooks into the main-frames?

Talkie Talk

A common problem with our electronic systems today, be it telecommunications, data processing or word processing, is the lack of facility in talking to each other. At least you might expect an office automation company to make all its products able to talk to each other, or to be able to take a floppy diskette from one machine and use it on another model. But this is infrequently the case. The industry practice of incompatability is geared to keep you buying from the same vendor, and lock you into the "tie that binds." There are some benefits to a single-vendor environment, but no vendor today offers a complete OA system suitable for every office. If the system is good for administrative typing, there is no guarantee that it is also good for scientific typing. If it is good for calendaring, it may not work well for form letters.

Even if you are committed to a multivendor environment, there are some planning guidelines:

1. Define an acquisition policy which can allow for overall planning, flexibility, and yet can be enforced. Those who want to go their own way can, but they should be fully aware of the consequences.
2. Don't assume any two pieces can be tied together within the system, even if both are marketed by the same vendor. Use a benchmark test to be certain of how the interface will be done. This is especially true for heavily formatted data or text, as formats are the most difficult part to transfer successfully.
3. Have your users become aware of the different compatibility levels:

    Physical connection: the plug fits in the receptacle, but no transfer of meaningful data is guaranteed (an alternate description is that the diskette fits in the drive, but no transfer occurs).

    Data transfer: content of a data stream is transferred across the physical connection, but the format may not be.

    Print image: Data, with format seemingly intact (but without codes to permit further editing), is transmitted.

    Editable text: The data stream, with most format codes translated to the receiving system's codes, is transferred.

    Complete transfer: The user does not need to consciously deal with the transfer problem.
4. Conversion software can be written, but vendors will write it only when it pays them to do so. No matter who writes it, the conversion is limited to what the receiving system can do.
5. Users should first investigate and clearly define their needs for information integration, then try to match these needs to either a standard single-vendor environment, or to a multiple-vendor system tailored to individual user needs.

"Don't Bother Me With Details, Just Tell Me What To Buy"

Too often our users don't want to fully investigate the feasibility of putting in a system. "It's too time consuming. The market place is too confusing. Just get me a machine that does the trick." Application definition and procedural analysis are frequently difficult for the office worker unaccustomed to information systems. And in many cases, definition of office system applications are equally difficult for the analyst with data processing orientation as the office is a dynamic, frequently changing arena of activity. One of the best methods for determining applications is to list the most critical ones, frequently found under the word processing function, install a small pilot system, and then chart the later uses (such as computer-assisted file indexing, records processing, list maintenance) developed creatively as the user gets to know the system.

Problem definition isn't the only difficulty faced in this "hurry-up" situation. The benefits of pre-implementation are completely overlooked as an added assurance of system success. The introduction of new technology is frequently unpredictable and disruptive. The new system can leave office workers with vague feelings of uneasiness. The feasibility study, even at a casual level of need determination, can be used effectively to bridge the gap between the decision to buy "something" and the people who will end up using the new boxes.

Consideration must be given throughout the decision process to the human impacts of the new system. Resistance to change in all of its forms should be encouraged early as a useful monitor for revising the system to better fit the real needs of the users.

Keep in mind the old adage: "select a small, salient problem and solve it with visible success within a few months." Innovation in the office arena comes at cost and risk, and is best driven by "demand-pull" rather than "technology-push."

From Ox Carts to Jets

In travels to Bolivia one is struck by the fact that the country has progressed so rapidly in the area of transportation that it has gone literally from ox carts to jet aircraft. What are the affects of the transition? Can we go in a similar leap from an electric typewriter directly to an integrated office automation system without any intervening steps? What are the consequences likely to be ?

We generally go through four phases of development in word processing. The initial stage is the electric typewriter approach, which includes such office technologies as a Roladex address file, a time/date stamp machine, 3-drawer filing cabinets, a ditto duplicating machine and the famous IBM

Selectric typewriter. Mind you, this is a very comfortable setting. It does not require much training and the secretaries and clerks are not edgy about new technology.

In the second stage the standalone word processor appears, acquired to raise productivity (read that "line counts"), keep up with the Joneses, or because a salesman sold the secretary on a slick, new piece of equipment. Other benefits are garnered: the saved keystrokes reduce proofreading time; the output is of higher quality with attractive formats, better selection of words, correct grammar and spelling. Also, when the author does the initial draft on the machine, a great time reduction is realized (for example, in preparing this paper using a word processor, it took only about one-fourth the time). With this introduction of a visual display terminal, some resistance to change is already evident: secretaries are leary of being trapped behind the screen without the more interesting interpersonal relationships normal during the working day. But after a year, the boss and the secretaries learn not only to cope, but refuse to go back to typewriters.

The third phase we see in word processing is the move to shared resources. The more costly peripherals (such as Winchester disk storage, an optical character reader, or a file server) can be accessed using intelligent workstations as well as terminals linked through a minicomputer. More sophisticatd word processing can occur, as well as other functions such as records processing, extensive file searches, retrievals and sorts.

The fourth phase is the integrated office automation system. It's spirit is reflected by such catchy phrases as "the paperless office," "the electronic office," or "the office of the future." This approach calls for an office philosophy that has moved from the limited, short-sighted single solutions of the standalone machines to a systems integration approach that features multiple functioned workstations capable of word, text and data processing as part of a network of such devices within the building or campus, linked to remote locations. It means a combination of shared-logic, multi-terminal systems and intelligent, standalone workstations which will provide for not only word processing, but all the rest of the pieces of the puzzle: electronic mail, calendar management, meeting scheduling, query languages, report generators, interactive time-sharing, networking and data communications, a window on corporate or institutional data processing bases, voice store and forward, electronic filing and retrieval, spread sheet and local computing, records processing, business graphics, and computer conferencing. It is possible that the jump from phase one to phase four, or even from phase two to phase four, may be too great for the average office. The transition from ox cart (the electric typewriter) to the jet (integrated office system) may be successful in only rare occasions. The more probable path to success is a slower evolution which allows the office workers to become comfortable with the new technologies in a more gradual, "natural" manner. We humans are slow to accept change, or to change our own behavior. It takes time, training, and patience to assimulate the capabilities of these new technologies into our office procedures.

"Well, Why Don't We Just Wait and See?"

Back to ground zero. Our users ask, "Isn't it true that if we wait long enough the technology will match our needs even better?" and of course the answer is "probably." But in the meantime those needs which originally stimulated thinking about office automation are not being met. "Administrivia" is having a compounding effect on the amount of paper we have to push around the office. Maybe, just maybe, we can cut down on some of the paper if we resort to electronic media. In the 1960's, we had terminals but paper was the media to read the output of the system. Today we have scrapped the punched card and the teletype in favor of the visual display terminal (VDT). Soon we may even be willing to send and file memos and letters electronically. The technology is here today to do just that. Perhaps the following data will help motivate us to turn our backs on the paper chase and go now for a solution which will meet many of our needs:

The Story on Files and Filing

* Only 20% of those things you file are ever used again.
* 98% of things filed will be used within 90 days.
* 7 copies are made of every document.
* 80% of these are filed in your own department.
* Stanford University admits to using a ton of paper per day!
* Only 5% of our timber remains!

Go With The Winners

"Consolidation" of the word processing industry has been predicted for years. This is a polite word for the concept of the survival of the fittest. True, we have seen some household names--AM International, Savin, Vydec--bail out of the word processing business in recent months. But that has not stopped some well known names from jumping on the band wagon in office automation, NCR, Sony and Honeywell, to name a few.

Because you plan to be around for the rest of the decade, you probably want to select an office automation vendor who can say the same. Managers want to deal with as much certainty as possible, but picking a "winner" in this business is almost as chancey as a trip to the race track. However, most vendors will spend the time to tell you about the corporation directions. Although the SEC rules will not allow them to make preannouncements, they can discuss "statements of direction" and even get into some specific areas if you are willing to sign non-disclosure statements.

The factors you must consider in assessing the likelihood of corporate success is similar to playing the stock market. However, consider the following indicators:

* Time in the office automation market place. Names, although common to the office place, like Xerox and NCR, may have just entered the field of office automation, so you must decide if it is a long term commitment or a "toe into the water." Note that some companies went into the word processing business and bailed out in less than 24 months.
* R & D Commitment. How much capital a corporation is willing to invest in designing leading edge technology is a vital indicator, as is the placement of those R & D dollars. Some vendors, like Exxon and NCR, bought their boxes from CompuCorp and Convergent Technologies; they'd rather invest their R & D money in software development than in hardware, or so they say.
* Service and Support. It takes time and money to build an adequate service (maintenance) and support (user training) base. We all know of firms, like Wang, that have been growing at better than 70 percent annually, and then have a hard time building a good S & S base at the same pace its marketing staff is placing orders. Yet,

if there is no commitment to S & S, one should consider it a good warning. By the way, the industry standard for service response is 4 hours, but you will be wise to check out the real performance history with customers rather than taking the vendor's word for it.

Going with the winners can also mean selecting the company that is most successful in this industry. If you consider the total volume of word processor sales by number of stations placed, your choice would be Wang (40% of the market), but Lanier has been the leader in standalone word processor sales. Or if you want the corporation that has the greatest revenues from selling office automation equipment, then it is an easy choice to go with IBM.

Going with the winners also refers to paying attention to those who have gone before, and through trial and error or some other process have established some successful guidelines for developing office automation:

Considerations of Review

- Initial dollar outlay and cash flow to be expected after initial installation, as well as maintenance and supplies cost, cost of adapting and furnishing office environment for best usage of new equipment.

- Availability, reliability, and quality of supplies, service, training and troubleshooting.

- Versatility of the equipment and upgradability into that utopian system of the "office of the future."

- Well-defined, and carefully selected applications to be addressed by the first phase of the solution, with a larger definition of the future, total picture.

- Scheduling of the pre-implementation, system selection, installation, training, and full implementation phases.

- Reorganization of procedures (and possibly reporting lines, as well as job assignments) necessary to utilize the proposed system effectively.

- How the system will interact with present and proposed systems already in place or being developed.

- Alternative methods of satisfying needs, including the continuation of manual methods, but with procedural revisions which get rid of blockage points and needless loops.

- Human factors such as personnel selection, psychological impacts of the technology, ergonomic and environmental factors.

And always we need to remember that the office is a continually changing, interactive environment, the product of over 200 years of development and refinement; office automation planning requires our best systems planning skills, total cooperation at all levels, and recognition of the need for continuous re-evaluation, for THERE IS NO SINGLE, LONG-LASTING SOLUTION.

THE FOUR P'S OF SUCCESSFUL MANAGEMENT

by

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A strong mnemonic model to aid in getting on top of and staying on top of the management challenge of computing in its many forms is presented.

THE FOUR P'S OF SUCCESSFUL MANAGEMENT

VEIL LIFTED

The shroud of mystery surrounding the secret to successful management can now be lifted. And, it reveals four pillars -- the four P's -- supporting the edifice of success. These four pillars are:

PLANNING	PROFESSIONALISM
PRODUCTIVITY	PEOPLE

ENEMY AND ALLY

But, beware. There is a pitfall. Seeing is not believing and believing is not doing. The principles must be put in practice. They must be practiced and polished -- every day.

This is a difficult path. And, there is an easy path down the hill of good intentions and into the pitfall of PROCRASTINATION.

But, while procrastination is the enemy of success, there is an enemy of procrastination. Our ally in this battle is PROCESS. If we can organize a process for each of the four P's that involves other people and has continuity and momentum, then we will have an ongoing mechanism that will minimize the likelihood of procrastination.

MANAGEMENT OF DP

Much has been written and spoken on leadership and management. Does it apply to the information resource environment? Are there differences?

I think we need to note five distinctions. They do not change the underlying principles, but they accent the challenge.

First, there is technology. How many hours a day could we spend keeping up with publications, services, mail, phone calls, vendor presentations and seminars? Few other occupations come close to the constant barrage of innovation in and near this field. Keeping up with the technology and how to apply it can become a preoccupation. But, unless we keep up, we find ourselves a generation behind -- talking about data processing when everyone else is talking about information resources -- talking about computer terminals when everyone else is talking about work stations.

Second, there is the service nature of computing. Few other occupations require the extensive communicating with users, our own staff, committees, our boss and many others too numerous to mention. We have to translate a foreign language. We think we have communicated, but it turns out that we haven't. And, the call we haven't had a chance to place leads to more problems.

Third, is the impact that we can have on the entire organization. As we continue to bring technology to our use, we take over more and more of the nervous system of the organization. It becomes more dependent on us and the impact of system failure can be crippling.

Fourth, is the work scheduling challenge that exceeds most others. We prepare a five year plan to show staff and equipment required to design, program and run systems that have not been defined. We have 54 projects in our latest schedule and a payroll change comes along that must go in today.

Fifth, is the sellers market for programmers and analysts. Few other offices are faced with the same difficulty in hiring and keeping good employees. This is especially noticeable when budgets keep us from competing.

PLANNING PROCESS

Planning, for some, takes the fun out of the voyage.

"We know basically where we want to go, right? Why spend half our time talking about it?"

These are the immortal words of Simone, the French explorer who did not become famous after sailing in a circle for many years.

Simone did have a point though. We don't want to spend half our time talking about where we want to go. And, since we need to involve many people in an effective planning process, this would be all too easy unless we get organized and establish a functioning process. We need to delegate responsibilities, come up with appropriate planning instruments, put some procedures into place, and follow up to make sure that it keeps moving.

Any planning that we do must support institutional planning, policies, and priorities. We can also make suggestions to institutional planning.

At the upper stratosphere, we would be looking out over an expansive vista, far into the future. We would ask questions such as, "What is the role of the Computer Center? What will it be 5 years from now, 10 years from now, 20 years from now? What are the trends in technology? What are the human functions, individually and in groups, that electronic devices can be used for? What role will communications products play in the future? What is the relationship of data base to communications to electronic work station?"

The basic white collar tools that were very distinct and isolated from each other have spread out in capability until they are now running together. The typewriter became electric and then electronic. It developed memory, then word processing power, then communications capability and now operating systems with application programs, disk storage and mainframe compatibility.

Typesetting has begun to follow a similar path. Copy machines could become facsimile transmission devices which could feed optical reading devices. The old dictating recorder evolved through shared electronics and communications and could continue into voice recognition and direct input to word processing or data processing systems.

Without looking ahead, we're likely to be behind.

A few organizations are recognizing the possibilities of reorganizing to bring like technologies and work functions closer together. Anything that deals with communication, information storage and processing or computing could conceivably be brought together in the reorganization. A vice president for communications, information and computing services might be a logical aggregation of functions.

If we go from a truly long range plan to a more structured five year plan, we will want to examine the functions currently served, how they could be better served, anticipate the near range impact of improved technology, and attempt to translate this into staff, equipment, and dollars.

Budgeting is important, not just because we need to have money before we can spend it. The way budgeting is conducted will affect the way computing develops. Will budgets develop from well justified application requests? Will there be chargebacks? Will departmental budgets for computing services and products be hard or soft money?

Major projects require their own project management. Like all plans, they should be consistent with and support other plans.

Operational planning is the bread and butter, ongoing process that keeps life interesting on a daily basis. Because it is such an ongoing process, there is no real beginning or end. I would like to describe the process I use at Old Dominion University.

The keys to this process are: four planning instruments, priority setting with users, staff participation in estimating required hours to complete, and regular feedback.

The four planning instruments are:

1. Service Request. This form initiates a request for analyst/programmer services and has space to describe what is being requested and when it is needed and other spaces for us to respond with estimated hours to complete and a tentative completion date.
2. Staff Allocation Plan. This is a form prepared by each application group supervisor at the beginning of the fiscal year to show the first six months, another is prepared for the second six months, and a third is prepared to cover the next full fiscal year. Each form has lines to enter each person in the group and then there are columns to show weeks and percent of total for each of the five following categories: supervision, administrative, education, systems maintenance and projects. The lower half of the form provides space to list individual projects and the estimated time to complete. By subtracting this list in the lower half from the total in the project column in the upper half, it is easy to determine whether there will be enough time available to complete those projects or not.
3. Project Log. This is a computerized system for tracking pertinent information on projects that have been received and logged in.
4. Time Sheet. This is a form to record analyst/programmer time to the five categories of time, application area and individual project, if applicable. We are working on an on-line screen for this.

The preceding list of instruments is used in planning sessions with users, tracking project progress and verifying that we are spending time according to our allocation plan.

The planning sessions with users has been best formalized with the financial applications. The Vice President for Finance, the Budget Officer, and the Assistant Vice President for Support Services (which includes Personnal) meet with me and the financial applications group supervisor every six to eight weeks to review the allocation plan and the project log. Manpower availability is discussed, priorities are reviewed, and commitments are made, both for us and from them if information or decisions will be needed.

The preceding illustrates the complete planning process which does not exist just to create a plan. It exists to carry forward the complete cybernetic process of planning, monitoring progress, taking corrective action, and reviewing the wisdom of the plan.

Effective planning provides an opportunity for communication and building consensus and commitment to goals. It depends on participation of the right people. This may involve many committees and meetings and should be well organized.

For example, at Old Dominion we have a University Computer Policy Committee, an Academic Users' Committee, an Administrative Users' Committee, and the direct planning teams that I described above. In addition, we have entered an agreement with Systems & Computer Technology Corporation to acquire new applications systems. Concurrent with this we also acquired an IBM 4341 to install these systems and others to offload our DEC 10 with administrative systems to leave it as an academic machine. To oversee this entire effort, we have a contract team with vice presidential representation, a project management team and an implementation team for each of the systems being acquired. As an adjunct to this, we have a Director of MIS outside the Computer Center and database custodians for each major system selected from the user community.

How do we function with this approach? First, we attempt to define the role and responsibilities of each entity. Second, we attempt to use them for productive purposes and keep meetings efficient. For example, we insist that a carefully prepared agenda precede each meeting, preferably with time for attendees to prepare in advance. Meetings generally are started promptly, are limited to an hour, and stick to the agenda. Written minutes noting decisions, actions taken, and open assignments or issues are promptly distributed afterwards.

PRODUCTIVITY

Going fast on the wrong course is rather pointless; however, assuming that we have regular planning to establish the right direction, then we want to get the right sails up and get the crew trimming the sails to give us maximum speed.

Productivity for the office depends on coordinated individual productivity.

Individual productivity is a function of talent, education, experience, skills and work habits. We need to evaluate these factors carefully when we hire new people. Hiring the wrong people can be expensive. We should also be sure that we provide adequate training, reviewing and coaching after people have been hired.

Another important factor is the work setting. There should be minimal distractions and interruptions. Tools of the trade should be readily accessible.

In addition to good planning, it is important that clear direction be given with an assignment. Miscommunication probably accounts for more wasted effort than anything else. Also, prompt decisions and ready access to needed information will minimize roadblocks and wasted time.

In addition to tools of the trade, such as a terminal, programmer productivity software should be investigated and acquired when cost justified.

Finally, there is one final link between what a person could do and what that person will do. That link, of course, is motivation. There is no single answer to this challenge since there are significant individual differences. I believe that having reasonably high expectations, getting commitment to dates, providing adequate recognition for work that is accomplished, appearing to be fair and expressing genuine interest in a person's work are major factors in addition to pay.

PROFESSIONALISM

Professionalism is a term that has been used too casually too often. To me, it stands for mastery of skills, maturity of judgement, awareness of role, willingness to use discretion, concentration on a job, respect for others, avoidance of petty office concerns, communications polish, diplomatic assertiveness, ability to provide knowledgeable consultation, and a recognition that we are judged by others as they see us and their perception of what we accomplish.

Professionalism is a quality product with a good paint job that gets regular waxing to prevent corrosion and potential disintegration.

PEOPLE

Each of the other three P's have dealt with people. The emphasis here is on people in the sense of humanness. It is how we treat people and how we are perceived by them. Respect, interest, caring, and fairness are characteristics here. There are many situations where firm, positive action is required. Anything less is perceived by others on the staff as weakness and undermines respect. People look for strong leaders. So don't misconstrue this P to stand for softness.

But, that doesn't translate to aloofness. People need to know that we care that they are coming to work.

SUMMARY

There you have it. In easy to remember, but rarely easy to use form, The Four P's of Successful Management. Beware the pitfall of procrastination. Build the machinery for ongoing process. And, build the four pillars of: Planning, productivity, professionalism, and people.

Containing the Damage - Quality Control of Local Data Production

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The human/judgmental aspects of effectively converting data into meaningful information--information that supports superior decision making--presents a problem not yet completely solved. This paper discusses this problem and some of the reasons behind the disappointment and disenchantment with management information system development to date. This paper assumes a skeptical stance and suggests that the problem can only be exacerbated by the continuing proliferation of major improvements in hardware as well as "end-user" software. It discusses the reality of increasing numbers of institutional operating department managers trying to perform the "data-to-information" function-- a task requiring information professionals --with sometimes damaging results. Examples will be used to illustrate the problems that arise from inappropriate local data production. A discussion of the potential for "quality control" of this kind of data will be offered.

Introduction - The Source of the Damage

> "One of the more persistent delusions to cloud our minds, in public as in private affairs, is the belief that for every problem there exists a solution if only we were clever enough to find it. Most of the real problems are intractable, if not insolvable; otherwise, we would have solved them long ago. It's just that we will not accept that reality."[1]

It is not the intention of this paper to be negative. However, there is ample justification for a significant level of cynicism about the past progress toward legitimate and viable management information systems. No literature on the progress to date of MIS design may be considered completely honest if it does not acknowledge the areas of disenchantment that have occurred at the level of the top decision maker. We now understand quite well the basic reasons for the general feeling that MIS has not been successful as a decision maker's tool. The villains in this evolutionary process go by the names OVERSELL and OVERLOAD.

There is no question that the promises of management information systems and data base management systems have significantly exceeded achievements; they have been OVERSOLD. The false expectations resulting from unrealistic assurances of computer professionals has inevitably resulted in occasional bitterness from management.

It is not difficult to find traces of past OVERSELL from those most knowledgeable of management science. Baldridge, for example, states, "Unfortunately, the availability of computerized data systems helps promote the silly notion that things are important if they can be measured, counted and reduced to computer printout."[2]

Van Horn very recently emphasized restraining enthusiasm over the computer. He said, "In a world appropriately filled with glowing promises for computers, managers are well advised to reflect on what computers are not." "A computer system, no matter how successfully applied to a problem, does not guarantee improvement...A healthy skepticism about the accuracy of the output is the best antidote to being stung by a hidden program bug."[3]

Overload is an equally bitter complaint of top decision makers. We now understand the generic problem of overload. Very simply stated, operating systems contain huge quantities of necessary data but operating systems are not management information systems. They have, however, been sold as such. The production of vast quantities of data from operating systems has hindered rather than helped institutional management decision making processes. Meg Greenfield once raised the interesting question in NEWSWEEK, "How is it that we have all this information but we never seem to know anything?"[4]

It should be noted here that the design and implementation of computer assisted operating systems has undeniably been hugely successful in higher education. The general state of financial distress in the industry depends upon computer assisted operations to increase productivity. The production of highly effective computerized tools has also greatly assisted management. Many institutions depend heavily on the ICLM, cohort studies, cost studies, enrollment simulation studies and all the other tools that would not be available without the computer. However, true management information system development remains a promise to top policy makers that is yet to be accomplished.

In the 1977 monograph "Appraising the Information Needs of Decision Makers," #15 in the New Directions for Institutional Research series, several authors express criticism of the status of information systems. The problems seem now to be well understood; Sheehan's summary seems fairly comprehensive:

1.) the lack of understanding about decision-making processes
2.) weakness in the total information systems approach
3.) an overemphasis on computational techniques
4.) the lack of progress in the identification and measurement of education outcomes
5.) the difficulties in integrating operating systems with decision-making systems
6.) the potential conflict between systematic management and the preferred decision-making style of academics.[5]

Although an enormous oversimplification, the solution lies in closing the gap between decision makers and technical staff. The emphasis clearly must be on the human side of information processing rather than on the system. McCorkle, speaking from the perspective of a decision maker, seems distressed by his experience with "staff". He points out that staff often lack in-depth experience with academic program management, that they "tend to become obsessed with accuracy" and that they often don't understand the basic nature of policy decisions. (To be fair, he states that top management may not have bothered to explain!) He points out that this schism between staff and management can result in a rise in management costs and the management decision process inadequately supported.[6]

At the point that decision makers, staff analysts and technicians all "wear one hat" (or, as Sheehan suggests, all wear three hats),[7] the problems of information systems support will be solved. We will know when our information problems are largely behind us because all levels of an institution--technicians, staff analysts and decision-making managers--will be "information professionals." Each of these participants in the decision process will have the qualities of a professional as emphasized by Bacchetti: "the sharing of responsibility for outcomes as well as output, for context as well as analytical episode or management event; recognition of the power and influence of conceptual structure; participation in the construction of meaning as well as provision of data and information. The definition of professional involves acknowledging that information is neither neutral nor necessarily benign; that the management scientist's responsibility can extend back to each beginning, to the organizing concepts within and through which the work will be carried out."[8]

The entire information technology movement has been characterized by unrealistic promises. It would be equally unrealistic to offer as a solution to information "quality control" the requirement that all managers become information professionals. That is a solution for the long run.

Quality Control in the Short Run

In the short run, there is much work to be done to insure an acceptable level of information quality control. The basic issue is that described by Balderston, "Raw data always needs to be aggregated, transferred, interpreted and appropriately conveyed to serve as information for decisions."[9] The task expands far beyond this description, to the establishment of information production processes and controls but begins at the level of institutional decision-making processes. We find that most institutions--some reluctantly perhaps--have decided that an analytic/quantitative decision-making process must co-exist with the traditional collegial/political model. This direction implies attempting to rise above costly crisis style management, with its sometimes exhilerating action but chaotic results.

The analytic/quantitative process requires that there be standard information definitions that are generally accepted and shared throughout the organization. The organization must then USE this generally accepted management information as a basis for actual management decisions.

This is not a short run task. It involves compiling reliable data longitudinally using well discussed and acceptable definitions. The data must be shared at all times with interested parties and reach the point of acceptability where discussions related to decisions do not have to debate the quantitative data involved but wholly the issues. Reaching this level of central information reliability and acceptance may be a long and painful process. However, the institution which has matured to such a level will find that it has achieved a very desirable level of quality control for central management information.

Operating departments may be swept up in this analytic/quantitative management style. For most departments, there will be a genuine desire to compile local data to assist in their own management. Some departments will have as a primary motivation for local data production, the need to "defend themselves." Still other departments will enter into the local data game out of curiosity or to "keep up with the Jones."

Conditions today, with more and more operating department managers convinced that they must enter the "data game", may exacerbate quality control issues. Computer hardware is rapidly becoming inexpensive and computer software is promising a level of "user friendliness" that will allow nearly anyone, regardless of sophistication level, to perform wonderful data feats. We have the bright promises of distributed data base technology that will allow us to "download" data from central files for the user to manipulate on his microcomputer. We have non-procedural languages to assist the user and we will soon have relational data base technology which will permit the user to structure the data any way he chooses rather than relying on the hierarchical data structure defined by the data base construction. The desk that does not have a terminal or a microcomputer will soon be the exception at some institutions.

The technology appears to be cost effective as actual prices are reduced. Ever mindful of the previously identified villains OVERSELL and OVERLOAD, we find operating departments enthusiastically plunging ahead with the construction of their own, essentially local operating systems and even what they believe to be "management information systems."

It seems logical and cost effective that centrally there is assistance for this movement to local data production to download the burden from central MIS functions. An example of the current thinking on this issue is found in a memorandum circulated at the University of Vermont in 1981 entitled, "The Need for a User Oriented, Data Management System." Outlining the heavy load on central staff, the memorandum pointed out user demand for "the design and development of new systems that are localized in a specific office which will improve the cost effectiveness of their operation." Because of acute staffing shortage in the industry, it stated, demands were not being met and the "offices are increasingly frustrated in their efforts to respond to the management demand to use the computer to reduce costs since requests are indefinitely deferred." A software product was recommended (eventually purchased) which was "user oriented, friendly, forgiving, flexible and non-procedural." One of the uses of such software would be that "many small, self-contained systems could be handled by the individual offices." The quality control issues in this kind of environment are enormous. Those who have struggled to contain the damage of bad data/bad information in the past can undoubtedly look forward to increasing pressures as local data production expands.

The potential damage from lack of information quality control occurs on two fronts--on the workings of internal management and on the information sharing dialogue between the organization and its various publics.

The internal damage has as its primary effect the slowing down of an efficient management process while the "right" data is sought and has a detrimental effect on communication among interested parties. If the bad information is not detected, however, the damage factor could be critical to an institution, resulting in potentially fatal bad decisions.

The external damage from bad information can be equally serious. Information supplied to outside constituents is linked to obtaining support through the "marketing" of the institution to donors, grantors, alumni, potential students and their parents, and government bodies. Great care must be used in the release of information outside the institution. There is the requirement in this instance for a blending of the information professional and the public relations specialist. Information must be accurate, easily understandable and consistent. This latter point suggests that information released by various units of an institution must tell essentially the same story. This has always been a major challenge to those concerned with information management; movement to local departmental information production will add another dimension of difficulty.

Quality control of information in the internal management decision process is achievable but requires significant attention and commitment to the problem. The following guidelines are minimally required to cause this to happen:

1.) A true information management function must exist, staffed by information professionals. This may be the central MIS group, the Institutional Research Office or other staff. Ideally, those key institutional functions which control critical segments of the data base--admissions, the registrar, personnel, accounting and physical plant--should be part of the information management function. Efforts to insure this are recommended, for it is virtually impossible to prevent these functions from collecting and disseminating operating system data.

2.) There must be staff training and management development to raise the information consciousness level of operating department managers. This is obviously critical but easily avoidable! Many administrators are not trained in basic management practices and the complexities they find in mature institutions. Such complexities require more sophisticated management training needs.[10]

3.) Top management must be part of the information management team. The entire information process is too important to be left entirely to staff support. Top management must be aware of what information is being developed and the process for information management and the quality control function. The top decision maker obviously can't perform information management personally but must have intimate knowledge of how it is being done.

4.) When "damage" occurs from bad information, there must be management follow-up. Investigation and analysis of the situation is essential in order to keep the attention of all managers strongly on information quality control.

With these policies and principles as a foundation, there can be focus on departments where local data production may be a problem.

Departments such as Development, the Alumni Office, Career Planning and Placement, Intercollegiate Athletics, Residential Life, Financial Aid and, of course, the Dean's Offices of individual colleges are the places to look for local data bases and information in need of quality control.

Information from deans' offices is often times produced to argue for a larger allocation of resources in the budget process. It is very possible that the local data base in a dean's office will show information that seems to differ from the central files in terms of student majors, credit hours taught and FTE faculty. The quality control here is simply that the central data base information is considered correct (and will form the basis of decisions) unless proven incorrect. Any data presented that hasn't been reconciled is not acceptable.

It should be noted that certain presentations of "local" data may be a manager's honest interpretation of the environment that differs from the central institutional interpretation. We know that a key element of strategic planning is environmental scanning in order that an institution may assess external forces and respond to such forces. Arns points out that environmental analysis must be open, lively, and creative and not left solely to staff. He states that there is "...the need for regular development programs for key line and staff officers aimed at maintaining and increasing their sensitivity to external environmental factors."[11] However, the perception of the environment varies from individual to individual. The only quality control of this kind of data is analysis to determine if there is a defensible basis for the perceptions. The final test of environmental data is whether or not it "fits" the "generally accepted" institutional perception. For example, if a Dean of the College of Agriculture provides data from his local data base that shows an environment ready to cause significant enrollment increases in his College, this could not be dismissed directly. There must be careful analysis of the data to discover whether there was any basis to it other than blind optimism!

There is one critical element of quality control that must receive constant attention in the current technological burst. The central information management group must have veto power of those local data base constructions that, because of their faulty design, would draw on inordinate and inappropriate levels of central system resources. There must also be veto power over those faulty system designs where the "local" data base may someday be part of or dependent on the central system.

Examples of potential local data problems might include the following:

1.) Local "student information systems" for "special" students (Graduate, Continuing Education, etc.) where data elements do not match the central student system.

2.) Local files on space, faculty effort assignments, equipment inventory, etc., that do not match the central system.

3.) Stand-alone sub-accounting files that cannot be reconciled to central accounting systems and that are intended to "feed" central systems in the future.

4.) Departmental costing models which do not use central system data.

5.) Local files of donors and gifts in the Development Office.

6.) Local files on "clients" in Student Service departments.

Summary

The following points relating to local data production are clear:

- It is unwise to be casual about unsophisticated users designing local data systems, regardless of the "user friendliness" of the software involved.
- Bad information released outside the institution can be most damaging. Policies and processes in this regard must have "teeth" in them.
- Quality control is expensive but lack of it may be significantly more so!

For the long run, a real effort should be made to educate managers in the science, and art, of information management. When managers at all levels become information professionals, the quality control function should be much less of a problem.

In the meantime, it is imperative that top management decision makers are themselves information professionals and/or have a strong, reliable, professional quality control staff and quality control process. Also, the design and construction of "local" data bases must be carefully reviewed by professionals to prevent bizarre designs and inappropriate data definitions. Hardware and software purchases must be reviewed so that some attention be given to cost effectiveness.

There will be some damage in the short run. We must be wary and skeptical but we should also be optimistic. We have learned much in a short time. Local data production will of necessity feature some trial-and-error, improving in quality over time.

We must remember that the perfect information system, featuring perfect quality information, will not make decisions for us. Meg Greenfield hinted at the larger issue when she suggested that it may be downright disagreeable to have perfect information--to KNOW something. She points out, "...there is the fact that when you actually KNOW something, you are likely to be held responsible for ACTING on it!"[12]

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PROJECT MANAGEMENT - THE KEY TO EFFECTIVE SYSTEMS IMPLEMENTATION

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An implementation effort of the magnitude required for a new financial accounting system requires more than just the software to be a success. Careful consideration must be given to management information requirements, organizational needs, paper flow and work efficiency, people upgrading by training, and a host of other related activities.

The role of project management is critical to the successful implementation of financial accounting software packages. Good management techniques will contribute to the task of monitoring and control of the implementation process. The lack of effective project management will lead to frustration on the part of project participants and usually user dissatisfaction with the new financial accounting system.

The implementation of a financial accounting system at a college or university presents project management with problems beyond the monitoring and control of the implementation process. Typically the implementation of a new financial accounting system requires a long period of time (usually 9 to 12 months) and the participation of many technical and nontechnical individuals from the college community. Project management's challenge is to ensure that project participants are motivated to perform the necessary implementation tasks throughout the implementation. To encourage the proper focus of project participants, individual tasks and subtasks need to be assigned along with target completion dates. These individual plans should be reviewed jointly by project management and staff on a weekly basis to monitor and control project progress. Timely and effective communication among all project participants is a key element which project management can control through frequent project status meetings.

Project management should be supported by a project organizational structure which allows for the contribution of ideas from a broad cross-section of the institution and establishes effective monitoring and control during the implementation. The components of the project organization are:

- Project Team - The project team should be composed of a cadre of people working full time on the design, development, implementation, user training, and documentation for the new financial accounting system. This team should include:
  - Project manager - The project manager will have prime responsibility for coordinating the day-to-day implementation. This individual should have a strong background in fund accounting and have good interpersonal as well as proven management skills. The project manager should expect to spend 100% of his/her time on the implementation. The manager should chair the user committee, supervise the project team, and be the focal point of all communication and correspondence with the software vendor.
  - Functional team members - One to four accountants should be assigned full time to the project depending on institutional size and complexity. These accountants will perform the tasks necessary to successfully

implement the new financial accounting system. They should have a strong knowledge of the institution and fund accounting, and be familiar with system implementation requirements.

- Technical team members - One to four systems analysts/ programmers should be assigned full time to the project depending on institutional size and complexity. These individuals will be responsible for all project data processing (e.g., review of functional specifications, programming modifications to systems of original entry and interdepartmental charging systems, program documentation, program testing, and system testing). They should be familiar with the application and system implementation requirements.

o User Committee - The User Committee is a key working group and normally consists of 8 to 15 representatives, from the following areas:

1. General Accounting
2. Budgeting
3. Sponsored Research
4. Auxiliary Enterprises
5. Internal Auditing
6. Data Processing
7. Selected School Business Managers

The User Committee should meet weekly, and members should expect to devote 20 to 30 percent of their time to the project. This group will function as a review forum for establishing policy and procedures for the new system.

- Policy Committee - The Policy Committee should be composed of key senior management personnel (e.g., Vice Presidents, Provost, and Deans). This group should meet periodically to review implementation progress and discuss general concerns and policy issues. These meetings should function as a political forum to ensure that everyone is informed.

Successful implementation of a new financial accounting system software package requires proper planning on the part of project management. Full implementation will require these phases:

- Phase I - Project Planning and Organization
- Phase II - Requirements Definition
- Phase III - System Development
- Phase IV - System Testing
- Phase V - Documentation
- Phase VI - Training
- Phase VII - Conversion
- Phase VIII - Post-implementation Review

The preparation of an implementation pert chart and supporting detailed workplan will assist project management in monitoring and controlling the implementation. The pert chart provides project management with a graphic diagram of major implementation tasks to be accomplished by phase and the sequence of activity. The detailed workplan is a focus on individual tasks and subtasks and a comparison of targeted vs. actual start and end dates for each respective part of the implementation.

BUYER BEWARE:
MANAGING THE SOFTWARE SELECTION PROCESS

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Buyer Beware:
Managing the Software Selection Process

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INTRODUCTION

As sophisticated software packages become more prevalent, cost effective, and qualitatively improved, many colleges and universities are turning to this approach as a solution to their administrative computing software needs. Purchased applications software has, however, created an entirely new set of problems for Project Managers charged with the selection process and implementation responsibilities.

The selection process is critical and commits the project to a course that is difficult and costly, if not virtually impossible, to change. The success of the project is significantly enhanced through the application of a reasonable and systematic approach to the software selection process. By following a sound selection methodology, the Project Manager is able to make an informed recommendation to executive management on the best approach to satisfy the user needs.

In practice, the functional and technical capabilities and limitations of purchased applications software have not received adequate review. The system study, needs development, and evaluation of alternatives have not been adequately defined as a total process. A fragmented and, thus, incomplete analysis results in a software selection decision based on misinformation, a lack of information, or an improper weighting of the known information.

The Project Manager is responsible for directing activities culminating in (1) a comprehensive needs study, (2) product/vendor evaluation, and (3) selection recommendation for the application software. This paper will expand on this process and, specifically, on the activities Project Management needs to engage in.

PROJECT FORMATION

When does a system project actually begin? When does a system project actually end? Both questions are difficult ones. The usual answer to these questions is based on an individual's involvement with and perception of a given project.

I would have a tendancy to answer both questions with, "Not soon enough." However, my perception and involvement as a Project Manager necessitates that I view system projects differently than a User Department or the Software Vendor.

Let us ask for a moment, "When does a project begin?". Usually, a project is in an enbryonic state when there is an awareness or perception of deficiencies with the current system. This current system could be completely manual or have various degrees of automation.

Deficiency awareness surfaces in the organization in a number of ways:

1) Audit - EDP and operational audit findings often bring this awareness of system deficiency dramatically to the surface in an organization.
2) User Dissatifaction - Users voice the scope and intensity of their dissatisfaction with a system.

Deficiency perception can be an effective catalyst to bring an organization to action. This action may typically initiate in one of two ways:

1) Vendors - Vendors employ product marketing methods that directly or indirectly reinforce a belief that current systems are inadequate and need to be replaced.
2) New Management - Executive or middle management, new or new to the position, often desire to initiate activities leading to a system change.

The Project Manager's awareness of how a project was conceived is vital to his effectiveness in implementing that project.

A Steering Committee should be appointed early in the project. The Project Manager should serve as an official member of the Steering Committee. At a minimum, Steering Committee responsibilities will include:

- Review and approve project activities,
- Establish and maintain an information link with others in the organization,
- Serve as the official group to receive and distribute project communications, and
- Make a selection recommendation to executive management.

I will now present and review several activities to be performed prior to the execution of a software contract. From a Project Management perspective, the project does not begin at the point of contract execution, but rather a dozen steps earlier. It is important to be aware of this process, of how each step contributes to the whole, and how partial or incomplete attention to the formal process can sabotage the entire effort.

THE PROCESS

System Study

The functional and technical characteristics of the current system must be documented through a system study. To compile this system study document, the Project Manager must be sure there is a comprehensive interviewing of staff, a complete review of all forms and reports associated with the present system, and verification of all existing documentation.

In a completed form, the System Study Report should include the following:

1) A summary of the system's functional charateristics,
2) An itemization of all system deficiencies,
3) The history of the system,
4) A Report and Forms Inventory with description and purpose statements, and
5) A program inventory with descriptive narrative.

It is critical to solicit and encourage maximum involvement from all areas either directly or indirectly affected by the new system. The initial contact should be made during the system study to identify the area involved with the current process.

This document will be a valuable reference during the development phase of the new system. The Project Team must have a common basis of understanding, with the user, of the current system that is being replaced.

Needs Document

The most important activity prior to selecting a software package is developing a Needs Document. The Needs Document can be developed by hiring an outside consultant to perform the study and draft the document, or by using your own staff and a formal methodology.

The content and format of the Needs Document will depend on the standards or methodology used. The document should serve as a ' definition of need' for the user, project members, vendors, and others with an interest in the system. In the Needs Document, the Project Manager should require the following:

- Basic functions of the system be clearly identified,
- Answer the question 'What is required?'
- Identification of areas requiring procedure definition,
- Interface requirements to or from other systems,
- Sufficient narrative to eliminate interpretation, and
- Listing of general and incremental benefits.

In developing the Needs Document and interacting with all types of users, Project Team members will encounter "functional expectation awareness". Coming from different backgrounds, users will have different knowledge of computing capabilities and different perceptions of what the automated system should or should not be doing for them. Project Team members must be attuned to the users' expectations of the proposed new system.

However, functional expectations and functional needs are definitionally distinct. Functional Expectations include the level of automation that a user believes can be provided. Functional Needs provide the level of automation the user requires to effectively conduct business.

Bi-directional lines of communication must be set in motion, especially in formulating the Needs Document. Frequent meetings, telephone calls, informal discussions, and the distribution of minutes or status reports are all helpful in developing a sense of project involvement.

All feedback - positive and negative - should be continually reviewed by the Project Manager. Some questions can be answered and items clarified now which will enhance the credibility of the total Needs Document. Enough cannot be said on the value of open and honest lines of communication.

In summary, the Needs Document is not a statement of personalized need as the title might indicate, but rather an acceptable compromise of needs to expectations.

Review and Approval

The Project Manager should personally deliver a copy of the Needs Document to each individual contributing to the draft for review. Sufficient time for the review must be allocated.

Others, because of their position and/or influence, should be given a copy for review and comment. The best approach to take with this group is to be totally up-front. Analyze critically the diversity of comments received and be willing to change the document accordingly.

Your primary goal should be to develop a Needs Document that has a wide base of support for sign-off approval. This is not implying that you should make changes that would lessen the quality of the product. Modifications to the Needs Document should only occur after the diversity of opinion has had a proper forum and a consensus or compromise has been reached. Use the framework of your Steering Committee to facilitate this process.

A difficult part of this review and approval process is for the Project Manager and/or Team Members to divorce themselve from the document as much as possible and to be flexible on change. This change often takes the form of a major document re-write necessary to obtain a sign-off and commitment to the project. To repeat, the primary goal of gaining a support base is imperative at this stage of the project.

ALTERNATIVE EVALUATIONS

Vendor Identification

Up to this point, the Project Manager has directed a System Study, developed a Needs Document, gained formal approval, and established a base of support for the project. Now, the Project Manager is ready to determine feasible products in the marketplace and take a systematic, logical approach in evaluating them.

First, identify as many software vendors as possible with a product to fill your functional needs. There are a number of ways to locate potential vendors:

- Previous Vendor Experience,
- Professional Organizations,
- Software Reference Manuals,
- State Agencies - such as the State Purchasing Commission,
- Other Universities,
- Publications,
- Computing Hardware Firms,
- Professional Conferences,

The primary objective of this step is to identify the software vendors with a product that may meet your needs. Once identified, make a telephone contact to the Marketing Division of each firm. Explain your project and inform them that a Needs Document is being sent for their review and initial response with a specific deadline.

Product Review

Upon receipt and initial review of the Needs Document, interested vendors will respond to the Project Manager. Initial responses, or lack thereof, are important and will help to narrow the field.

At least two or three of the responding vendors should be asked to make an on-site presentation of their package and to gear this presentation to the Needs Document. The Project Manager should ensure that adequate facilities are available and a representative audience is invited to these sessions. The continued involvement of individuals in your organization is critical to 'maintaining a base of support' for the project.

Subsequent to the vendor presentations, review of available documentation on the system, and personal conversations with employees of the software firm, the Project Manager should now consult with the Steering Committee to assess the product in the following areas:

1) Technical Requirements - Ability of the system to operate in the organization's computing environment.
2) Functional Requirements - Ability of the system to perform the functions specified in the Needs Document.
3) Implementation Requirements - Subjective evaluation of the required level of implementation effort.

If the software product adequately fills these requirements, then a formal bid request should be made at this time.

Bid Evaluation

The Project Managers request to selected vendors for submission of a written bid, should specify the following as required:

- Product description and program inventory,
- Itemized cost schedule,
- Vendor support days for installation and training,
- Definition of what constitutes product delivery, and
- Options for supplemental modules/programs.

Vendors often view the formal bid document as a final opportunity to formally market the product. Recognizing this, the Project Manager can expect a great deal of product marketing narrative. This extra verbiage can make the task of finding and summarizing the essential items difficult and time consuming.

The Project Manager should locate and summarize each essential item outlined above. Only by going through this exercise can the Project Manager compare written bids. After this comparison, a summary should be prepared noting the differences in the bids for the Steering Committee. The Project Manager's role is to facilitate the selection process through timely and relevant information dissemination.

Vendor Review

Concurrently with the bid evaluation activities, a vendor review is conducted. A purpose of the vendor review is to be knowledgeable of the vendor and the product, to be comfortable in a contractual relationship.

Project leadership should recognize that a vendor bias may exist in the current environment. This bias can be dealt with by involving enough people directly in the review activities to minimize the impact of this bias on the decision-making process.

Review activities should be concentrated in two areas: (1) Client Contacts, and (2) Vendor Contacts.

The first, client contacts, can be handled in a number of different ways ranging from telephone contacts to on-site visits. Planning and coordination of the activities in this phase are important. Otherwise, the process would lead to the collection of incomplete and non-comparative information.

Telephone interviewing offers an inexpensive, effective way to contact a sampling of vendor clients. Assign serveral contacts to each member of the Steering Committee. Develop a standard questionaire and get documented answers to the following types of questions:

- How does the system rate overall in meeting your requirements?
- Was the vendor support satisfactory for implementation and training?
- Does the system interface well with your other systems?
- Was the vendor documentation understandable and comprehensive?

Subsequent to the telephone interviews, conduct an open discussion of these comments with the entire Steering Committee. Trends indicating vendor and product strengths or weaknesses may become apparent.

Often on-site visits to other user locations are non-productive because they are premature. On-site visits to evaluate vendors and the product are costly and often timed poorly. If the on-site visit is to become a part of the total selection process, then planning, timing, and site investigation are imperative to cost-justify this activity.

On-site visits to the vendor's place of business are quite beneficial. Corporate organization, work environment, employee morale and product familiarity can be observed first hand. Try to keep these visits as unstructured as possible and spend a little time wandering through the offices to meet employees. Remember your objective: to reach an awareness level where you can feel comfortable in a contractual relationship with a particular company.

Contract Negotiation

The Steering Committee is now ready to make a software selection recommendation to senior management. The selection process has taken a deliberate and systematic approach to accumulate and evaluate information about the implementation environment, current systems, and functional and technical needs. The necessary approvals have been obtained. In addition, vendor identification, product reviews, vendor reviews, and bid evaluations have been addressed systematically.

Given this informed selection recommendation, a formal request for a contract should be made.

In the contract negotiation phase, at a minimum, the Project Manager should ensure the following:

1) Immediate involvement of University legal counsel,
2) Clear contract definition of product delivery, and
3) A payment schedule tied exclusively to product delivery.

CONCLUSION

A brief description of the software selection process, will give the reader an overview of each phase and present approaches for Project Management activities. By following a reasonable and systematic approach to software selection, the Project Manager can expect several benefits:

• Set Project Tone	- From project "inception", the Project Manager can establish this as an organized endeavor.
• Maximize Information	- The Project Manager can ensure that the plethora of information available is complete, relevant and comparative for the Steering Committee review.
• Encourage Involvement	- The process helps to create an environment that encourages project involvement.
• Enhance Decision Making	- The Steering Committee can make an informed recommendation to executive management.

The benefits will carry over to the project implementation phase. Implementation success will be enhanced by viewing the selection activities as a 'total' process and directing the project accordingly.

COMPUTER SERVICES:
IS THIS A CONTRADICTION IN TERMS?

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COMPUTER SERVICES: IS THIS A CONTRADICTION IN TERMS?

One of our users and I were discussing the meaning of the word "oxymoron" the other day. Webster's Dictionary defines it as "a figure of speech in which opposite or contradictory ideas or terms are combined." I came up with "sanitary landfill", to which he responded with "athletic scholarship". I said, "How about 'prep sex' or 'military music'?", and he suggested 'legal brief', 'greater Toledo', and 'COMPUTER SERVICES'. I would like to say that I was surprised, but as I thought about how we got to where we are, I could understand why he considered 'computer services' an oxymoron.

Genesis

In the beginning, data processing meant punching holes in cards, sorting them on a card sorter, and feeding them into a machine to produce some type of report. While this saved a lot of time in manual sorting, it was not really computing. The 8K machine rapidly gave way to the 64K machine, however, and capabilities increased with the power of the computer. Storage went from cards to tape, and more data was available for manipulation, providing more and better information. While data processing was still considered somewhat of a novelty, people started to rely on the machine to help with the tedious tasks. The Computer Services organization became more and more important to the success of the operation, and managers started asking more and more from their computer shops. The manager of the shop was usually the programmer who had been there the longest and had the misfortune to be chosen as director. With little or no planning, the Computer Services departments evolved in one of two directions:

A. Some shops really relished all of the attention. The Director was eager to show everyone what the machine could do, since he firmly believed that "anything is possible". As a result, he tried to solve every problem of everyone who came in the door. The Director was busy programming like everyone else, so management of the programming activity was nonexistent. When a user got a report produced that s/he liked, s/he would return to the programmer that had created it with the next request. Since the systems were almost always stand-alone, the programmers could modify, add, or delete functions without anyone ever noticing. As other managers started to see results in the departments of their peers, they started going to the programmers as well. When a programmer left the organization, a different programmer would modify the programs in response to the user's next request, but no one really had any idea of how an entire system worked, since documentation hadn't been invented yet. Finally, the individual programmers weren't able to keep up with all of the requests, and changes that they did make to systems they hadn't worked on before turned out to have problems. As they fell behind, the users got upset that Computer Services was not being as responsive as it had been, and went complaining to the director, and then to the director's boss. The boss fired the director, and brought in someone to clean up the mess. To sort out what systems existed, what was in production, and who was familiar with what systems took the new director eight to twelve months, during which no new work got done. The users either gave up in disgust, or went out and hired their own computing people.

B. Shops with directors that were technical wizards (i.e., that knew how to wire a board for an interpreter) did not want any mere user slowing down their machine with some trivial need. They would talk to the user about what the user thought he needed (at that time it was always a 'he'), and would then sit down and design a system that would run well on the machine. When the user timidly explained that the system didn't meet his needs, the director/analyst/programmer/operator would give out a resounding "hurumph" and tell the user that he not only didn't know what he wanted, but also was incapable of understanding anything that would run on a computer anyhow. After two or three rounds of this, the user would develop his own manual system and leave the Computer Services shop to 'twiddle their bits'.

While these shops were on opposite ends of the organizational spectrum, the effect on the user in both cases was the same. He was in need of data processing capability, but was unable to get any meaningful level of service from the Computer Services department. What was becoming more available, however, was package software developed by outside vendors. They were springing up behind every bush and tree, advertising in professional magazines, holding 'hospitality suites' at conferences, all claiming to have just the software to meet the users needs. All of the demonstrations and sample reports looked good, so the user plunked down his money and took the system home (this was in the old days when everyone had money). The people in the Computer Services shop back home installed the programs (they had a new director now) but no one really understood how they worked. Since the user had never done a serious requirements analysis, he was really surprised when the new software didn't do everything in the way that he expected it to be done. The Computer Services shop was asked to make some modifications, but given the complexity of the system, it was like punching [illegible] marshmallow - a fix to one problem ended up causing another. Computer Services, who felt that their integrity had been slighted by the package purchase (it was a "hog"), said, "Don't come crying to us when it doesn't work; we don't know anything about that system", and further isolated themselves from the users. Some of the users even started buying packages that came with maintenance so that they didn't have to hassle with Computer Services. When that didn't work, they resorted to hiring their own systems analysis staff.

So Where Do We Stand?

There are still data processing people out there in the basements of higher education that think that they are doing their job well because they don't have a backlog. They cannot figure out why they still report to the Second Assistant to the Vice Chancellor for Gutter Repair (SAVCGR), and why their budget requests for more computing power are ignored year after year. They do not realize that, were it not for the fact that many users have had no alternative but to use their services, they would have been reclassified to receiving clerks years ago. It is precisely this situation that has led to the establishment of companies that specialize in the management of data processing departments on contract. The time is rapidly approaching, however, when the user will no longer have to rely on the Computer Services shop for performing the day-to-day tasks of the office. Service bureaus have been capitalizing on user dissatisfaction for a long time by selling cost-effective data processing support to users who do not want the problems involved in dealing with the Computer Services shop. The horror stories from organizations with internal computing departments have often been sufficient to convince new organizations to use service bureaus from the outset and not even bother with having their own data processing capability. More recently, however, the "second technological revolution" has provided the user with cheap computing power over which s/he has some degree of control. Machines are now available that can sit on the manager's desk or in the mop closet and out-perform some of the largest computers in use ten years ago. Often, this computing capability is integrated with an office automation system that will permit the manipulation of data until the numbers are right, the inclusion of those numbers into a letter or report, and the electronic distribution of that report to others throughout the organization. The networking capability of these systems provides for more efficient communication as well as text processing and data processing support, and it is all under the control of the user! The disgruntled manager no longer must rely on Computer Services to provide information. The only interface necessary is the ugly business of getting raw data, but that can be tolerated if Computer Services will then disappear. When applications become too complex for the manager to handle, s/he need only hire a systems analyst to work in the user area (and therefore be responsive to the needs of the user area) developing applications that address specific user problems.

The Computer Services director can (and probably does) be smug and point out that sooner or later things are going to be such a mess that the users will have to come back to his/her shop for help.

In their excitement to use their new toys, users are going to develop transaction processing systems that require a great deal of data input, data storage, and periodic execution cycles. Certain key information will be duplicated among systems resulting in inconsistent reports. With systems being developed by users they will be poorly documented, and with changes in personnel there will be no one who understands how the systems work when modifications are required, even though the software salesman said the development language was "self-documenting".

While the Computer Services director may be right, s/he cannot affort to sit idly by and watch the users hang themselves. For one thing, the director's boss is going to get tired of seeing purchase requests from users who are requesting hardware primarily to avoid dealing with the data processing shop. For another, when the anticipated end comes and all of the users dump their home grown systems in the figurative lap of Computer Services, the director is not going to have the personnel, the knowledge, or the computing resources to manage the mess. S/he would be well advised to drain the swamp before the alligators get large enough to be dangerous.

A Structured Approach to Swamp Draining

There is a key word in the title of "Computer Services" that describes their reason for existence. The data processing shop exists solely to provide services to the users, to assist the user departments in performing their functions more efficiently. How this concept escaped early Computer Services directors is unclear; perhaps they became caught up in the technology. It must be foremost in the minds of present day directors, however, if their shops are to grow with technology instead of being swallowed up by it. The users of Computer Services services must be considered customers, and treated in a manner that will make them want to return when they have additional needs. It must be easier and more cost efficient for them to come to Computer Services than to go to Computerland.

To develop an understanding of what it means to be a service organization, it may be helpful to consider what we look for from our vendors.

- We expect a prompt response. If we call a software house and ask about their product, we expect a salesman to call or to send out some literature within a couple of days. When we decide to buy, we don't expect the vendor to say, "Well, we can't schedule installations more than thirty days in advance. When we can fit you in we'll let you know."

- We expect adequate documentation. When you buy a bicycle for your kid, and it comes in pieces, you expect that there will be some directions for putting it together. When you buy a new calculator that has the capability to do everything except defrost the refrigerator, you expect a book of instructions to tell you how to make it work.

- We expect the product to work the way it is supposed to work, as defined by the documentation. If we don't read the documentation and the product doesn't work like we thought it would but does work like the instructions said it would, we can't complain much about that. But if the instructions say one thing and the product does another, we are rightfully upset. With a contract programmer, we would consider this breach of contract, and wouldn't pay for the work until it was fixed.

- We expect service after the sale. When the Maytag breaks down, we expect that service man to wake up and come fix it. We get upset if he says, "I'm only one repairman, and there are a lot of broken machines. I'll fix it as soon as I can, but I can't tell you when that will be."

- We expect courteous service. We don't expect the person behind the counter to either say or imply that we don't know what we need or that we don't know what we're doing.
- We expect answers to our questions. When a fuse burns out in the car on a cold, rainy day and you call the dealer to find out where the fuse box is, you don't want to hear, "Did you read the Owner's Handbook, you nitwit?"
- We expect technical expertise. The Electrolux salesman would starve if he came to your home, poured some vile substance on your carpet and couldn't clean it up.

To determine the objectives of the Computer Services shop, therefore, the question that must be asked is, "What services should be provided to make the data processing organization most valuable to the user community?" These services fall into three major categories:

1. Operational Support

The Computer Services shop has historically had as its primary activity the support of administrative functions such as payroll, accounting, budgeting, admissions, registration, and student billing. If academic computing is part of Computer Services, operational support also includes providing students and faculty with the computing resources to complete their projects or accomplish their research. This must still be the primary thrust of the data processing shop. But it is certainly possible to perform this function more efficiently than it has been performed in the past. In order to do this, it is necessary to understand, and to be sure that the users understand, the concept of data ownership. The systems being developed, maintained, and run by Computer Services do not belong to Computer Services. The systems and the data they contain are controlled by the departments who use them. Once this is clear, operational support is simplified, because the user decides what processes should occur, when they should occur, and the sequence in which they should occur, and the Computer Services shop is responsible only for insuring that the requested schedule is met. With responsibilities clearly defined, the completion of production data processing activity becomes a team effort, with each of the team members controlling the part of the process about which they are most knowledgeable and which they are capable of controlling.

2. Technical Expertise

Data processing, for all of the advantages it provides to non-technical users, is a highly technical field which users find hard to understand. And since data processors have an aversion to documentation, they abbreviate everything they write and most of the things they say, resulting in a language filled with acronyms. This is all very confusing, and the user needs to have someone to help sort through the mess to determine how technology might be of some help. Computer Services should provide that assistance. There are some managers who want to know all of the technical details. This is sometimes a conditioned response to the years when s/he received nothing but bad advice from the old Computer Services director, or the result of purchasing an Apple II Plus to balance the checkbook at home. It more usually results from an interest in wanting to know what they are paying for. Computer Services has a responsibility, as the resident technical experts, to teach the users anything that they want to know about computers and data processing that will assist them in doing their jobs or in making better decisions. If this means explaining different hardware options and their associated costs, there should be no reluctance to do so. It should be understood, however, that the typical user doesn't want to know model numbers, doesn't care about baud rates, and wouldn't recognize a communications controller if it bit him. The expertise must exist in Computer Services to understand the user's problem, and to develop a solution that the user can understand and work with. To do this, Computer

Services must have a grasp on current technological trends, and be able to put that knowledge to use in developing an optimal solution to the users problems. In the past, these solutions have been implemented by the Computer Services shop; in the future, the assistance given to the user may consist of recommending which microcomputer and associated software to buy, and then either developing the application or training the user in the manipulation of the package software.

Technical expertise is not limited, however, to knowledge about hardware and software. There is most likely no one in the organization that has done as many projects as the Computer Services shop. In many cases, the same project has been done two or three times. There is therefore no one better qualified to provide guidance in project management than Computer Services personnel. In some cases, there will be system installations that do not involve the host machine, but are serving specific needs in user departments with standalone processors. The systems may be being developed by contract help or through the installation of a package system. In such cases, Computer Services can be of assistance by providing guidelines for needs assessment, assistance in hardware and/or software selection, and standards for programming and documentation. Such assistance is not only helpful to the user, but it provides a familiar framework for Computer Services when, two years down the road, the user finds that modifications are necessary and the contract programmer has moved to Portland.

Finally, technical expertise covers the internal workings of production systems. While Computer Services should make every attempt to document system functions for the user before they go into production, there are always going to be questions arise that can be answered only by reading the program documentation or by looking at the code. It is true that the systems belong to the users, who control the rules governing the system functions and the processes used to carry out these functions. But the users are dependent on Computer Services to make the program perform the processes, and the data processing shop should therefore be prepared to respond to users questions in these situations. If the users begin asking without first reading the user manuals, they should be referred to these documents and be encouraged to examine them more closely before asking the next time. But their questions should not go unanswered, since Computer Services is the only group with the technical expertise to answer them.

3. System Development

As computers have increasingly become a fact of life, more and more day-to-day tasks have been taken over by application software, freeing up people to do other things. Over the years, we have developed transaction processing systems to address high volume, repetitive processes, to the point that almost every person in America is dependent on the computer in some way. These systems are still our bread and butter; they are what we do best because we have had more practice at them than at anything else. The process used in their development still has a great deal of room for improvement, however. The systems that have been designed in the past have tended to be poorly documented, inflexible when modifications were needed, and cumbersome to run. Computer Services must give more consideration to these areas of the application development process to keep from being overwhelmed by a backlog of maintenance, and to keep up with the user's requirements for modifications to the systems brought about by changes in their operating environment.

The systems we have developed in the past are capable of generating enough paper to keep every man, woman, and child in the world confused for life. In fact, there is so much information being produced that users are now asking for systems to control their systems. As the keeper of the operational data of the university, Computer Services has a responsibility to work with the users to massage that data into a form that can help managers to make better decisions. This means getting the right numbers to the appropriate people in a form they can use in time for them to use it. The information needed will often be more than just an aggregation of current data to provide statistics. It must also be projections of that data to permit the manager to look into the future before making the decision today.

As with operational support, development of management information systems/decision support systems must integrally involve the user. Ten years ago, most users could not see past their green eye shades, and the information they needed to make decisions was as hard to define as the meaning of the universe. Today, with more models available, users are finding it easier to state what information they need to make decisions, even though they do not always know precisely how the information will be used. The Computer Services shop must be prepared to assist the users by providing the needed information and helping to manipulate it in a timely, efficient manner.

But How Do We That?

Talk is cheap. How can any of these things be done when the computer capacity and personnel resources aren't even available to operate and maintain the systems that are currently in production? The key to progress is to take advantage of the new technology rather than to work in competition with it. In order to do this, it is necessary to be aware of what advances are occurring in terms of both hardware and software. This could be accomplished by hiring 45 graduate students to read all of the publications that cover advances in these areas. Unfortunately, budgets for full-time readers are hard to come by these days. A second, less costly albeit less efficient, option is for the Computer Services director to set aside part of his or her time to read a few key publications each week. In addition, reading the junk mail that is received from vendors provides some idea of the kinds of products available to help with the problems being experienced in the typical data processing shop. A number of options are available to address the hardware overload problem.

- Distributed Processing

  Mini- and micro-computers are available that can handle moderately sized files and do the job of the mainframe with acceptable levels of response time. Even if the files are archived at the host site, data can be sent to remote locations periodically and processed, taking a major burden off of the central machine. This approach also has the advantage of reducing the impact of mainframe downtime, which always occurs during the time of heaviest processing loads. The systems to which distributed processing is applied must be selected carefully, with consideration being given to the nature of the data being processed remotely and the capability of the machine doing the remote processing. But this technique can effectively free the central computer of a portion of it's processing load, permitting it's use in tasks that cannot be so easily distributed.

- Stand-alone Systems

  There are many applications in the institution that require little or no data from central data bases, and need not interact with any other systems. Consideration should be given to using mini- or micro-computers in a stand-alone fashion to address these needs. This is not to say that the user should be given a machine and a box of floppy diskettes and be left to design a system. These are still application systems for which the Computer Services shop is responsible, and as such are subject to all of the standards for analysis, programming, documentation and training that would be used for any other system development project. It may, in fact, be necessary to develop special standards for systems developed on these smaller machines, due to the nature of the general purpose software used in the applications. Whatever the nature of the standards, however, they should prepare the user to operate the system to the same level that a person using a mainframe system would be prepared.

Allowing the user to have their own small computer has the added advantage of easy access to package software for word processing and data analysis that is not readily available on most mainframes. With appropriate software and/or hardware, these small machines can also function as terminals to the central computer when necessary, resulting in increased access to central data bases for authorized personnel, and the possibility of low volume distributed processing. This could be especially helpful in the offices of upper level management, where summary information from central data bases could be analyzed quickly in support of institutional decision making.

- Office Automation

The "Office of the Future" can be purchased from any one of a number of vendors and be on the receiving dock within a week. These systems can do almost anything you want them to do, as well as a few things you wish they wouldn't. What they do best is word processing. Word processing is like air conditioning - it is hard to imagine how anything ever got accomplished before it was invented. It can be helpful to any office that has to correspond with the inside or outside world (yes, even for Computer Services), but it is especially helpful to those offices that do a great deal of revisions to documents (e.g., user manual maintenance) or send out a large number of standardized letters (e.g., admissions). Office automation systems are often capable of communicating with the host computer, permitting the access to data such as student addresses. This eliminates the need to print labels that are later affixed to envelopes; the word processor can type the envelopes when it types the letters, saving a step in the process. Office systems usually have an electronic mail capability, making the production of a paper document in multiple copies optional. The document can be sent to the appropriate electronic mail boxes, read, answered, and electronically filed or discarded without ever being printed to paper. This capability can reduce the amount of "telephone tag" that occurs in any institution by allowing the sending of messages that would be too lengthly to leave with the best receptionist. Some of these systems even have the the capability to keep calendars electronically. This, of course, results in the undesirable capability to poll calendars when setting up meetings to see when everyone is available. Managers are thereby forced to enter their golf games on the computer, which could lead to all sorts of unacceptable results.

It should be noted that, while free standing word processors are comparatively inexpensive and can be purchased without a great deal of planning, the installation of an office automation system is a significant and expensive undertaking, and must be well thought out before a commitment is made. Networks require cabling, which tends to be a labor-intensive task. It also means a great deal of disruption in the workplace. But the cabling will not be nearly as disruptive as will the manager whose office is not included in the office automation network. This means that a thorough study of institutional needs, system capabilities, and expanion possibilities must be undertaken before any system is purchased. Most vendors will be more than happy to assist in the planning effort, but the results of such a study tend to be predictable. It is usually advisable to do the study yourself or get help from someone who has no vested interest in the outcome.

The systems that the Computer Services shop designed and installed in the past were not particularly flexible. They were built to address a specific need, but when the users requirements changed, it was a major undertaking to modify the system to meet the new needs. As more systems have been put into production, the number of personnel necessary to maintain them has also increased to the point that a large majority of the programming resources of the typical Computer Services shop now goes to maintenance. One way to meet the users demands for new development is to hire more staff to do the work. If the users are willing to wait for this to happen, however, they don't need their systems very badly. Given that additional personnel will probably not be available before the second Ice Age, the Computer Services director must look at ways to improve the productivity of the people currently on the staff. This can be done by making systems easier to develop and easier to maintain. There are several advances in software that can help.

- Data Base Management System

Data base systems have been evolving since the mid 1960's. Over the years a number of packages have been developed based on three basic models. But they have all been attempting to solve the same problems. First, data base systems reduce the need for data redundancy, resulting in more consistency in the analyses performed and greater confidence in the data by the user, from accountants to auditors to chancellors. Second, they reduce the amount of time needed for system development, since most file management tasks are handled by the data base software. Third, additional data elements can be added to a data base with minimal impact on existing programs. This permits the expansion of an application system without a major conversion effort. Fourth, it is often possible to join one or more data bases together using common data elements, resulting in almost unlimited flexibility in terms of data access.

Data base management systems come in all categories, from generic (suitable for everyday use) to "integrated families" of software. These megasystems usually contain a data dictionary, query facility, communications software, and an application development system, among other things. Data base systems are also available to run on almost any hardware, from micro's to mainframes.

- Application Development Systems

In an attempt to reduce the time needed for developing a system (and to make a little money as well), a number of companies have designed application development aids that are meant to increase programmer productivity by reducing the work required to get a program into production. Most of these systems deal primarily with on-line application development, and address the cumbersome processes involved in dealing with the teleprocessing monitor. With the increased emphasis on timeliness and accessability of data, more and more on-line applications will be required from users, and anything that will help in this effort should be considered. While application development systems don't fall into the same category as Dr. Casey's Snake Oil, the Computer Services director must exercise some caution when listening to the fast pitch. Vendors make a big point of how their interactive screen design capabilities permit the programmer/analyst and the user to sit down and design a system together. It should be noted that "Screen Design Does Not a System Make", and the productivity aid has not yet been developed that can eliminate the need for good front-end analysis. Also, consideration must be given to what modifications will be required to existing documentation standards when the programming is done in something other than the shop standard language. While it is necessary to keep an open mind in terms of taking advantage of new ways of doing things, it is not necessary to compromise one phase of the process for improvements in another.

- Query Facilities

Timeliness and accessability - there are those words again. Users are insisting on having data at their fingertips when they need it and in a form that they can use it. Unfortunately, they cannot predict exactly what data will be needed and the format in which it will be needed for the next ten years. There will be times when the users wish to access their data files without submitting a programming request and waiting for six months for a system to be developed. Some clever vendors out there have developed systems to permit this kind of rapid access, presenting the data in a plain brown format. Some systems permit the requests to be made interactively; in others, they must be run in batch. Computer Services must be cautious here as well, making sure that data is secure and that users don't develop a myriad of systems in the query language that take inordinate amounts of processing time at month end. But while the purpose of the query facility must be made clear, the capability for the users to access data quickly is helpful both to them and to Computer Services, since it reduces the number of requests that are in the programming backlog.

- Security Systems

With all of this access to data, the chances for abuse are greatly increased. The Computer Services shop, as the keeper of the university data, is responsible for its security. There are a variety of systems available to assist in this task as well. Most security systems utilize name and password protection at various levels. While some protect only to the file level, others provide security at the screen level, the transaction level, the data element level, and, occasionally, the value-of-the-data-element level. It should be noted that security systems are often integrated with data base management systems or application development software, making their implementation dependent on the purchase of the entire package. "Plug compatible" software, for the most part, is not yet a reality.

- Operations Support

As the Computer Services shop grows and the programmer with cards in his hip pocket is replaced by an operations group, a customer support group, and a system development and maintenace group, the number of systems in production increases dramatically. While many have on-line capabilities, most (including the interactive systems) still require batch updating and/or batch reporting. Timeliness of data dictates that the systems be updated more frequently than ever before, resulting in a significant workload for operations. In order to get the work done and the data into the hands of the users, some production/operations support software should be considered. Production scheduling systems are available that will accept run sequences and will release a job when the previous one has executed satisfactorily. This reduces the amount of operator intervention required, thereby reducing the time lost when the system is idle waiting for the operator to finish removing and bursting the output from the back of the printer. These systems also provide status reports of which jobs finished successfully, which did not, and which are still waiting to be run.

Tape management systems can be extremely useful in reducing the time currently spent specifying volume serial numbers. The job control language need only specify a fixed data set name, and the system assigns tapes from a scratch pool, records the tape numbers, and determines the generation number. If a tape file goes to multiple volumes, the system will remember it. In addition, with a retention period specified, the system will return tapes to the scratch pool when they are the proper number of generations old.

Change management systems provide operations with an orderly approach to problem control. Such systems are usually associated with a "help desk" facility of some sort. When a terminal or some hardware component fails, the problem and the person assigned to handle it can be recorded in the system. Any subsequent action can also be recorded, making the status of the problem instantly available to the user who calls to inquire. These systems can be used to control software changes as well, including both corrections of program problems and system enhancements.

While these tools can make the operations section run more efficiently, they must be approached with the same caution used in evaluating any product. Operations support software tends to require a large front-end conversion effort. If done improperly, or if the software is not fully understood before installation, the works can become terminally gummed up. If used properly, however, they can provide significant increases in productivity.

Stalking the Elusive Management Commitment

There seems to be a Catch-22 here. Computer Services cannot take advantage of these productivity aids to increase their level of service without increased resources. This means that the managers who allocate the institution's resources must be committed to an improved information system. At the same time, top level management is reluctant to allocate funds to Computer Services when the only "services" of which they are aware are computer breakdowns during registration and incorrect payroll deductions. The key to breaking this stalemate is to start small and work up. A concept widely discussed in recent years is that of Information Resource Management, or treating information as an asset of the institution, giving it the same priority as physical plant, personnel, or investment funds. This is our goal. To make it top management's goal, we must demonstrate that they can get the same or a better return on an investment in computing as they get from an investment in more people or more buildings. When top management funds a project to develop a new system, Computer Services must work with them to set goals and objectives, keep them informed about project progress, produce a useable system, and demonstrate improved results in the department for which the system was developed. When top management asks Computer Services for data, it should be supplied to them with a minimum of hassle in the form that they need it. If Computer Services wants more software, the request should be well thought out, with justifications and expected results, along with alternatives for solving the problem in other ways and their associated costs. If the software purchase is approved, Computer Services should document the resulting improvements in productivity as backup to the rave reviews that will be coming in from the users.

Initially, the steps taken to gain management commitment should be the high visibility, high return type of activities (e.g., improving on-line access to existing data files). As confidence in the capabilities of Computer Services increases, and possibilities for further improvements become more clear, top management will be more willing to allocate resources to improvements to the foundation of the shop, in areas such as computer hardware and personnel. With this level of management commitment, and with a service orientation toward system users, 'Computer Services' will never again be used as an example of an oxymoron, a contradiction in terms.

TRACK III
Technology and Techniques

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Charles Beranek
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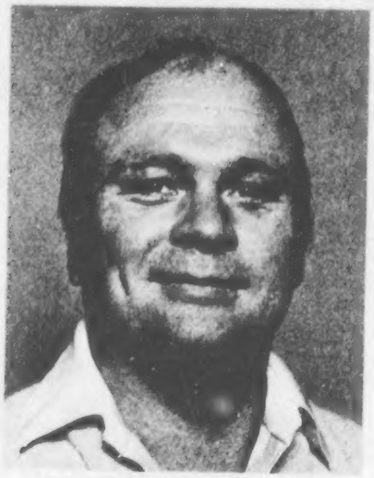

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Will FIRN's Really Grow in Florida?
(Florida Information Resource Network)

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In a bold attempt to reduce the data burden on educators, provide timely administrative information to decision makers and provide sufficient academic computing at a reasonable cost, the Florida Information Resource Network (FIRN) blends the two dominant communications technologies with the service needs of the entire Florida educational system. FIRN augments an existing IBM SNA network in the State University System with an CCITT X.25 facility, along with the capability for users to easily transend from one domain to the other. The combination is intended to service a very high percentage of the terminal types and processors that exist in the State education system.

While this program is significant from the standpoint of technology, it's political implications are likewise noteworthy. After seven years of jousting, Florida's State University System and Public K-12 Schools merged their networking needs and talents for a unified legislative appropriation request. Funding of this project has produced a somewhat unique management structure, crossing once taboo lines of educational autonomy.

The FIRN pilot project, starting in January 1983, will be a one-year test to insure that all of the technical requirements of this data communications portion can indeed be met.

The Florida Information Resource Network document to be submitted for this presentation is a public record document to which I was a major, but not sole, contributor. Many knowledgeable people in the state of Florida also contributed to the final document which is now covered by Florida Statute 119.

Will FIRN's Grow In Florida? - October 1982

by

Glenn W. Mayne

The State University System of Florida (SUS) computer network has experienced a broad and comprehensive evolution over the past eight years. Starting in 1974 as a single phone circuit to allow Board of Regents staff (BOR) access to computing capacity at the Gainesville data center, the network has blossomed into a maze of circuits, modems, multiplexers and terminals that stretches from Pensacola to Miami and from Jacksonville to Ft. Myers. The network now offers batch job access to all five SUS computing centers from any job entry station in the system along with multi-center interactive terminal access from eight universities for administrative, instruction and research processing.

Growth of this facility has been piecemeal, based on individual processing needs and has always been implemented in the most cost-effective fashion at the time. The result is a configuration that does not offer the reliability needed nor is it possible to quickly and effectively maintain the network when breakdowns occur.

The SUS computer network user community has experienced the benefits of the existing network and continues to ask for more services. What is needed is an improved communications facility that is separate from the computing centers and will support the three main types of terminals used in the SUS as well as a wide variety of computer types. Such a facility must feature high reliability and ease of maintenance. It must also feature a Technical Control Facility that will set and enforce network standards, be responsible for daily operations and act as a focal point for maintenance throughout the entire network.

With recent legislative interest in the development of an educational computer network, the slow but steady growth in the number of non-university educational users gaining access to the network, and the emerging emphasis on providing automated reporting capabilities to school districts and community colleges, it is clear that a more reliable, maintainable and cost effective way for handling data communications must be implemented. It is the general feeling that the SUS Computer Network logically should serve as the foundation upon which an improved educational network facility is built.

During the Fall of 1980, the BOR MIS office established a network technical committee comprised of the associate directors of each regional data center, and charged it with the identification of the next step to be taken by the network. This group reviewed the history of the existing facility, its current limitations, current positive factors and anticipated needs for the future. It was quickly determined that the IBM System Network Architecture (SNA) portion of the facility should be retained and enhanced. How to do this and add the features that SNA lacked or did not perform well was the issue at hand. In addition, this group felt strongly that the end product must be capable of evolving into a statewide facility for all Florida educational entities and possibly for all state government agencies. Thus, representatives from the Department of Education and Department of General Services were asked to join in the deliberations and proceedings.

After several visits by this committee to vendor communications development sites, it was determined that a formal Request for Information (RFI) document, to be released to the vendor community, would be of great benefit in telling what the state-of-the-art in communications could offer. The RFI was developed so that it contained all of the functions and features that are sought by the Florida educational system. After considerable effort, this document was finalized in late December, 1980, and issued to sixteen computer and communications vendors.

In March, 1981, the committee received eight formal responses to this document, and found that four were very complete. Each of these four were asked for an oral presentation on how they would configure and install a pilot project between Miami, Gainesville, and Tallahassee. This pilot would be on a one-year lease and would be used to test out all desired features and functions. At the end of the one-year term, the SUS would have the option of purchasing and expanding this solution or start seeking other alternatives. In any event, the capabilities of the solution would be a known factor before fully committing to a long term, expensive investment.

During two days of intensive evaluation, the committee found that only two solutions were acceptable. While there were still numerous questions on the solutions presented, it was obvious that:

1) At least two vendors could provide the functions features and interfaces necessary for the next step in the SUS network.

2) Both viable solutions use the international standard packet switching protocol X.25.

3) Access to public data networks was possible and could be of great benefit.

4) Such a solution could be the foundation for an educational network in Florida and could possibly be expanded to serve all of Florida government.

An attempt was made to secure funding for the pilot during the 1981 legislative session, however, it started too late and was not successful. During these attempts to secure funding, however, the committee learned that the Legislature was asking the School District Comprehensive Council on MIS (SDCCMIS-featuring representation from each of Florida's 67 public school districts) to develop a plan for information gathering and reporting. With the ambitious goal of having an interactive terminal in every Florida school, this concept became known as the Florida Information Resource Network (FIRN - aah, it finally has an appropriate acronym!)

FIRN obviously has a challenging data communications requirement that is very similar to that of the university system. This, however, is the trivial portion of the effort! Needs for applications software in the districts and at host repository centers, along with the need for a rigid data administration function are monumental, for FIRN deals not only with a statewide network, but with data collection software, sharing of operational software, summary reporting data bases, ad hoc queries to all districts from the State level, forms and data element control and management considerations that transcend all of Florida's public education entities. Why such an ambitious undertaking? A very simple question with a rather simple answer - Florida, like most states, funds its educational system based on the number of students it serves. Thus, timely and accurate information on the student population, what it is doing and how it is supported, available in an understandable format by state decision makers, is the motivating force behind FIRN. There are, of course, numerous other benefits that come from such a facility - more efficient use of communications circuits (currently telephone lines), availability of instructional computing by more students, and reduction of paperwork demands on teachers are a few noteworthy areas.

Recognizing the similar data communications needs of the public schools and universities, the legislative staff suggests that perhaps the SUS network solution might be applicable to the FIRN. Perhaps the SDCCMIS and SUS should work together on a joint solution, at least in the data communications area. It was felt that such an approach would be favorably received by the Legislature.

Asking two or more legal entities in the Department of Education (DOE) to work together is done quite often, but with rather limited success. Regardless of the logic associated with the given assignment, autonomy, turfdom and who is in control usually surface as the major issues. Over the years, DOE-wide computing efforts have certainly experienced their share of inter-divisional jousting! Thus, this noble and logical suggestion was not given much of a chance, based on past history.

From the outset, this joint venture was different. Sharing only the data communications portion of the problem reduced a lot of the "who is in control" issues and the numerous advantages of having a state-of-the-art communications facility quickly established a non-conflicting common objective with mutual benefits to all concerned. Throughout the summer and fall of 1981, each side worked to gain the confidence and respect of the other. The result was a team effort with enthusiasm rarely seen in the public sector. FIRN was steadily taking shape, as the SDCCMIS and SUS participants molded thoughts into reality. The plan included data communications, data administration, information processing and a governance structure across the DOE divisions.

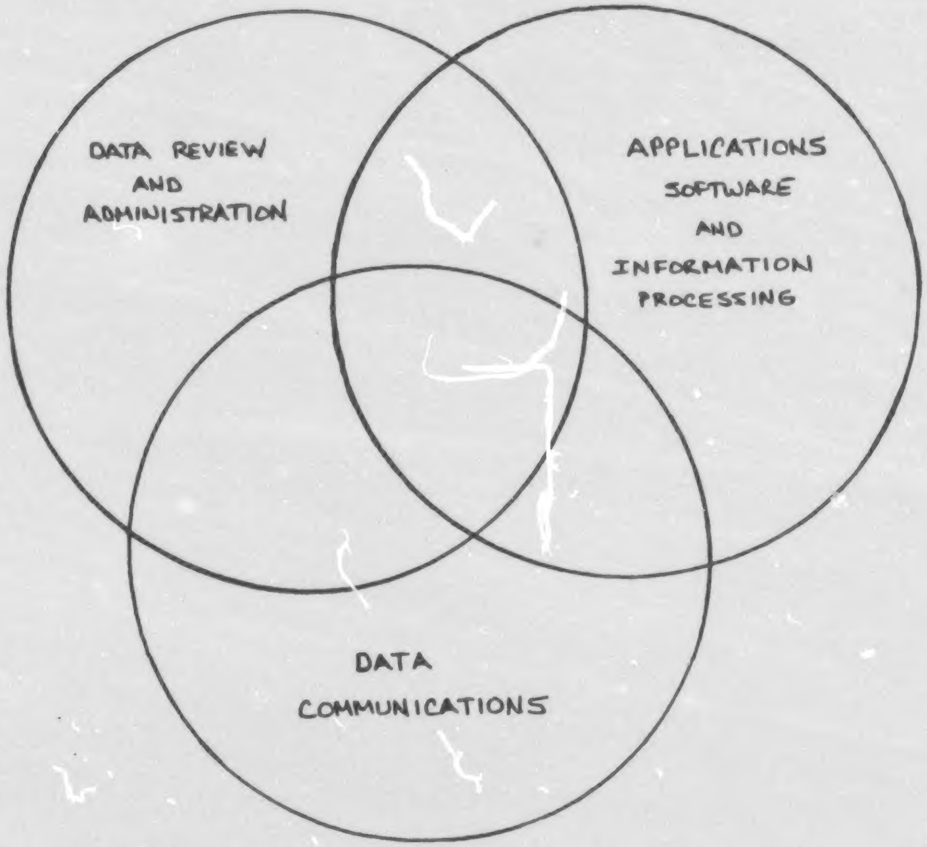
The FIRN plan (also known as 'the green book') was submitted on time to the Legislature in January, 1982. While data communications represents only one-third of the plan, a network pilot project (as previously defined in the SUS effort) is the first step toward full implementation of the plan. This project would feature two major network technologies (IBM's SNA and the CCITT X.25 recommendation) blended together to serve the wide variety of terminals and processors in the Florida educational system. Equipment installed in Miami, Gainesville and Tallahassee would be tested for one year, to determine if all functions can really be achieved. Existing terminals at UF, IFAS, FIU, BOR, Putman and Broward Schools plus new equipment in Gadsden and Dade Schools (to include IBM 3270 type, ASCII start-stop devices, JES2/NJE remote job entry workstations and X.25 compatible equipment), will be used to perform this test. Based on the success of this data communications pilot, the much more complex job of applications implementation and data reporting will be incorporated into this facility.

During the 1982 Legislative session, FIRN survived the test of time and politics. The project received an appropriation that will provide for the network pilot project and start identifying and developing applications during FY82/83. Legislative acceptance of the FIRN plan and the pilot appropriation was based on several factors: They, themselves, felt the need for such a facility. The report was clear, concise and accurate. A solution for communications was available in off-the-shelf form. All of these are valid points, however, it must be noted that the shock effect of having results from two DOE divisions working together was certainly a major influence on the final decisions to support the plan!

Will FIRN fully come to pass? Only time will tell. At this point, specifications for the pilot have been prepared, a bid has been let, and the DOE has made an award to Tymnet, Inc. Installation of the pilot communications equipment is currently set for January, 1983. Public school student registration data transfer to Tallahassee is set for March, 1983. University production data traffic is scheduled for cut-over in April, 1983. The project continues to remain on schedule, which is in itself a significant accomplishment! By the end of calendar 1983, we should have a sound answer to the question, 'Will FIRN's grow in Florida?"

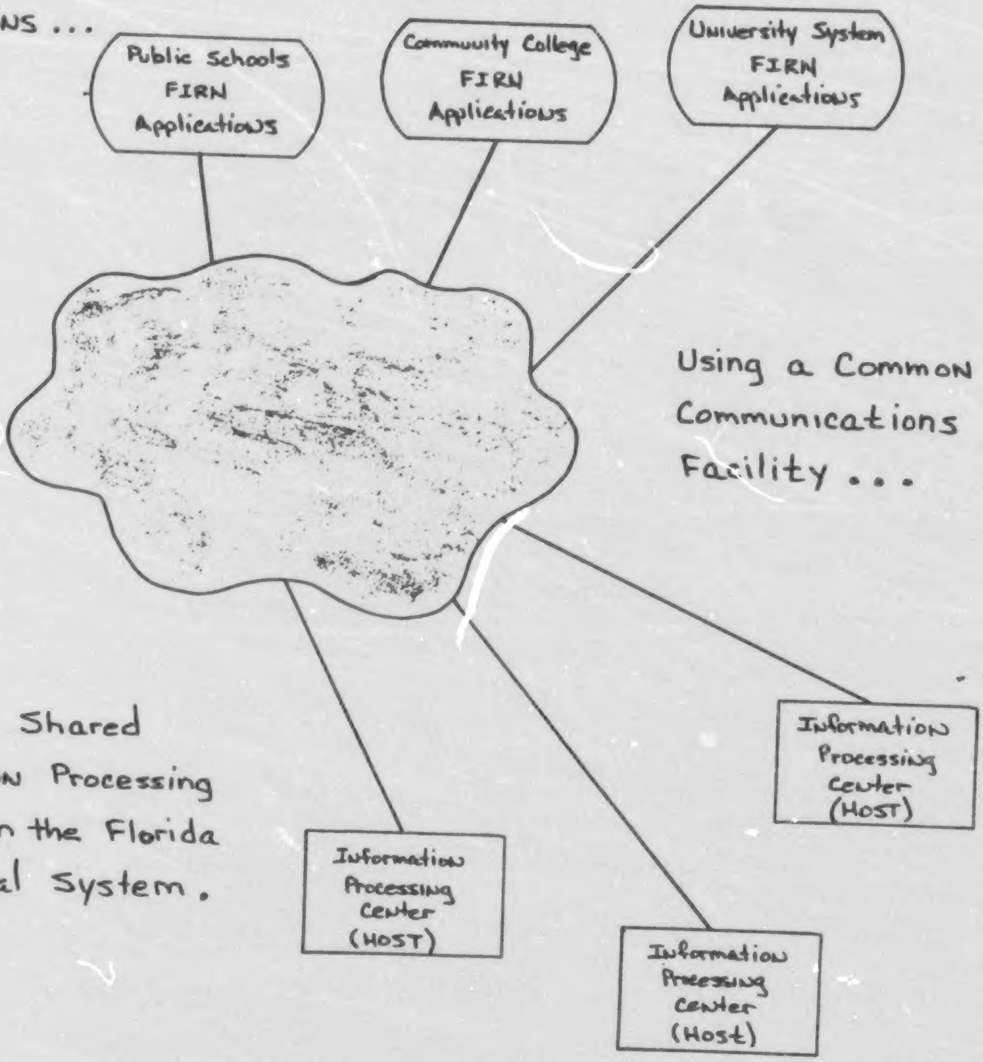
Glenn Mayne is Associate Director of the Board of Regents office of Management Information Systems and serves as Coordinator of the State University System Computer Network.

FLORIDA INFORMATION RESOURCE NETWORK


DATA REVIEW AND ADMINISTRATION
APPLICATIONS SOFTWARE AND INFORMATION PROCESSING
DATA COMMUNICATIONS

FIRN Features:

Separate Development and Management of Applications ...


Public Schools FIRN Applications
Community College FIRN Applications
University System FIRN Applications
Information Processing Center (HOST)
Information Processing Center (HOST)
Information Processing Center (Host)

Using a Common Communications Facility ...

To Access Shared Information Processing Centers in the Florida Educational System.

WHY?

Teacher Data Burden Reduction

Automated Reporting

Record Keeping

Instructional Computing

Accuracy and Timeliness

Automated Procedures

Resource Sharing

Equitable Access

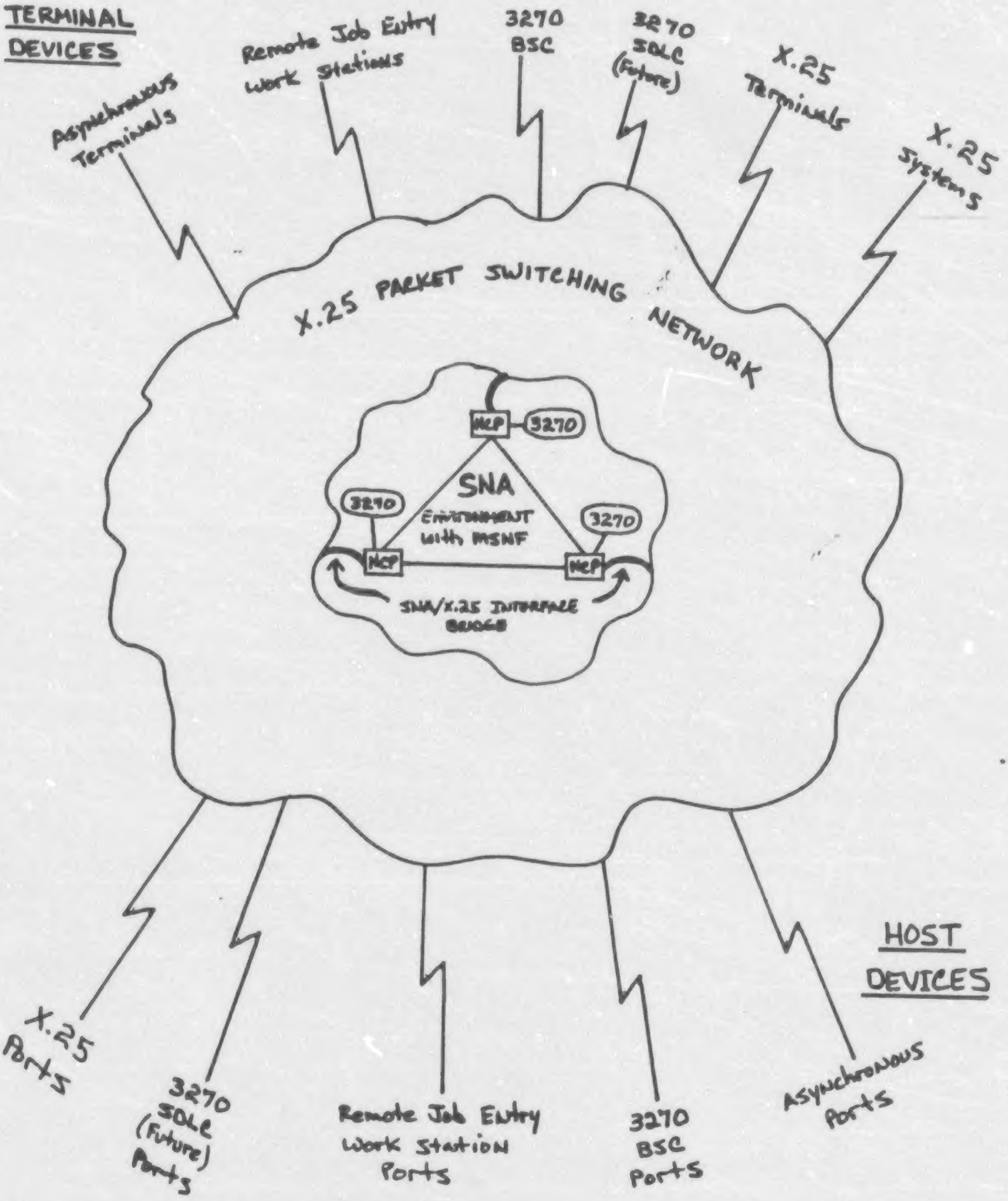
Cost Reduction

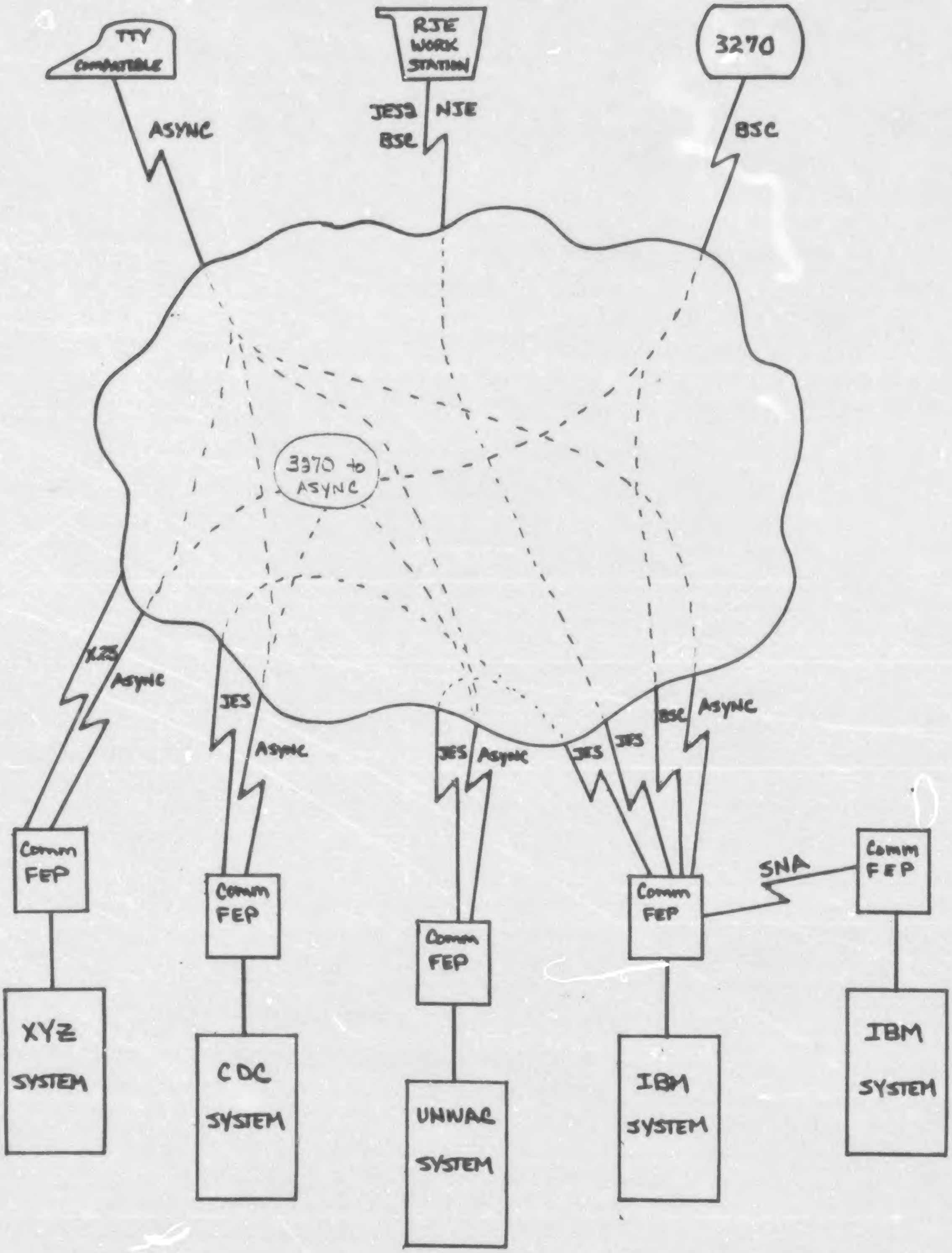
Innovative System

Non-Data Processing Co-op Model

Electronic Mail

CONCEPTS FOR THE FIRN NETWORK


TERMINAL DEVICES
Asynchronous Terminals
Remote Job Entry Work Stations
3270 BSC
3270 SDLC (Future)
X.25 Terminals
X.25 Systems
X.25 PARKET SWITCHING NETWORK
NCP
3270
SNA
Environment with MSNF
NCP
3270
NCP
3270
SNA/X.25 INTERFACE BRIDGE
HOST DEVICES
X.25 Ports
3270 SDLC (Future) Ports
Remote Job Entry Work Station Ports
3270 BSC Ports
Asynchronous Ports


TTY
COMPATIBLE
RJE
WORK
STATION
3270
ASYNC
JES2
BSC
NJE
BSC
3270 to
ASYNC
X.25
Async
JES
Async
JES
Async
JES
JES
BSC
Async
SNA
Comm
FEP
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Comm
FEP
XYZ
SYSTEM
CDC
SYSTEM
UNIVAC
SYSTEM
IBM
SYSTEM
IBM
SYSTEM

USE OF ASCII TERMINALS WITH A
PROTOCOL CONVERTING CONTROLLER

by

W. H. Branch
University of Central Florida

December, 1982

This is a case study concerning the implementation of a RENEX translator (protocol converting controller) to utilize ASCII terminals as IBM 3270 equivalent terminals.

HISTORY

The University of Central Florida, with a student population of 14,000 students, has made an effort in the last year to increase on-line activity. In the fall of 1981, the Department of Computer Services received a number of requests for new on-line terminals from several administrative departments. At the same time, Computer Services was utilizing ASCII terminals (ADM3A and Televideo 920) as interactive terminals to a Harris 550 computer and ITT Courier terminals to an AMDAHL V6 at the Northwest Regional Data Center (NWRDC) for development/maintenance work. Most of our programmers/analysts commonly switched back and forth from the two types of terminals in performing their duties. Further, a number of ASCII terminals (ADM3A) had been assigned to key personnel for home use during off-duty hours. This allowed them to locally dial into our Harris computer facilities and save travel time to the University. Since the NWRDC was located in Tallahassee, it had not been economically feasible to set up dial-up facilities for work there. In light of these circumstances and the fact that UCF was also utilizing a MICOM port selector (allows port concentration) for general campus use, it was obvious that a protocol converting controller (PCC) would:

1. Allow better utilization of existing ASCII terminals.
2. Provide local dial-up facilities to the NWRDC computer.
3. Release the ITT Courier terminals for administrative departmental use.

PROTOCOL CONVERTING CONTROLLER

For those of you not familiar with a PCC, it is a device which allows asynchronous ASCII terminals to communicate with an IBM or equivalent computer as 3277 or 3278 terminals. This allows access by ASCII terminals to all application software (full screen edits, etc.) which normally requires a 3270 type terminal. The ASCII terminals may be directly connected to the PCC or, by use of asynchronous modems, the ASCII terminals may dial-in.

IMPLEMENTATION

At the time UCF was investigating a PCC, only two vendors responded to inquiries. Both RENEX Corporation and Carterfone Communications Corporation provided on-site demonstrations that convinced us that indeed a PCC would be beneficial to our operation. Further, we felt the added keyboard activity (see Appendixes A, B, & C) required on the ASCII terminals could be handled by our programmers/analysts. There were doubts about placing this additional burden on administrative users. However, using the dial-up facility for infrequent on-line inquiry or placing isolated terminals in remote locations would certainly be economically justifiable when compared to synchronous terminal implementation for administrative users. Keyboard awkwardness has been overcome by several vendors now offering ASCII terminals with 3278 equivalent keyboards (notably Beehive Corporation's DM78 and RENEX 378). Configurations of equipment before and after implementation of the RENEX Translator is illustrated in Appendix D.

COST EFFECTIVE

Appendix D illustrates the hardware configuration UCF operated prior to acquiring the RENEX translators and after implementation. You may note that a second RENEX unit was added and terminals requiring only NWRDC support have been placed in administrative departments utilizing Beehive DM5A terminals with Okidata Model 82A dot matrix printers attached. We have also utilized EPSON MX80 dot matrix printers with the Televideo 920 terminals within Computer Services. Cost factors are illustrated in Appendix E. As you can see the hardware was cost-effective. Although maintenance prices are not illustrated, cost savings are evident there, also (depending on location). The equipment we have utilized has been very reliable.

BENEFITS AND PROBLEMS

Benefits experienced by use of the RENEX translator are illustrated in Appendix F. Cost savings and dial-up capability are the major benefits experienced. I might add that programmers/analysts, if given a choice, would still prefer synchronous terminals.

Major problems experienced are illustrated in Appendix G. The greatest problem by far has been maintaining a mixture of ASCII terminals. In other words, the staff stuck with the lesser expensive terminals (i.e., ADM3A) requiring more keyboard activity versus the Televideo or Beehive are always grumbling for a better terminal. Standardization of terminal equipment would improve the work environment.

ADVANCES

Appendix H illustrates some advances in PCC equipment since UCF first implemented their RENEX translator. PCC's are available that will support multiple hosts with restriction options for terminal port usage. Almost any ASCII terminal now available on the market place can be supported by a PCC. Personal and desk top computers can now be interfaced to a PCC for added capability. IBM's personal computer and displaywriters can now emulate the IBM 3101 which can access most PCC's. As an experiment, UCF utilized an option of a Commodore 8032 personal computer to emulate a Televideo 920 terminal to effectively utilize it as a 3270 terminal with our RENEX translator. We are not productively utilizing this capability, but I'm sure more development in the personal computer arena and local networks will further enhance the use of PCC's. Appendix I illustrates the CC76 PCC available from Beehive International which includes TOPPER which is a standalone personal computer.

SUMMARY

Implementation of PCC's have been useful to UCF, allowing programmers/analysts to easily switch activity from one computer system to another, establish a VTAM dial-up capability and support VTAM on-line applications in remote department locations inexpensively.

APPENDIX A

ADM3A

FUNCTION	KEY (OR SEQUENCE)
CLEAR	CONTROL C
DELETE CHARACTER	CONTROL D
ENTER	RETURN
TAB	CONTROL I
BACK TAB	CONTROL U
RESET	CONTROL R
HOME	HOME
ERASE INPUT	ESC !
ERASE END OF FIELD	ESC "
INSERT MODE	ESC #
PF1	ESC 1
PF2	ESC 2
PF3	ESC 3
PF4	ESC 4
PF5	ESC 5
PF6	ESC 6
PF7	ESC 7
PF8	ESC 8
PF9	ESC 9
PF10	ESC 0
PF11	ESC :
PF12	ESC -
IDENT	ESC ? nn*
COPY	ESC @
PA1	ESC [
PA2	ESC]
PA3	ESC ^
TEST REQUEST	ESC }
DUP	ESC {
FM	ESC ~
NEW LINE	CONTROL N
CURSOR LEFT	CONTROL H
CURSOR DOWN	CONTROL J
CURSOR UP	CONTROL K
CURSOR RIGHT	CONTROL L
CURSOR SELECT (Light Pen)	CONTROL T
Screen Refresh	CONTROL V
Status Display	CONTROL A

*nn = 2 decimal digits (01 through 08) which defines the target device.

The character options should be set for 8 data bits, bit 8 equal to 1, parity inhibited and one stop bit.

APPENDIX B

SPECIAL VERSION FOR UNIVERSITY OF CENTRAL FLORIDA

TELEVIDEO 912, 920 (B&C); 950

FUNCTION	KEY (OR SEQUENCE)
CLEAR	CLEAR SPACE
DELETE CHARACTER	CHAR DELETE (on 920/950) or ESC W
ENTER	RETURN
TAB	TAB
BACK TAB	BACK TAB
RESET	CONTROL R
HOME	HOME
ERASE INPUT	ESC !
ERASE END OF FIELD	ESC "
INSERT MODE	CHAR INSERT (on 920/950) or ESC Q
PF1	F1
PF2	F2
PF3	F3
PF4	F4
PF5	F5
PF6	F6
PF7	F7
PF8	F8
PF9	F9
PF10	F10
PF11	F11
PF12	ESC -
IDENT	ESC ? nn*
COPY	ESC @
PA1	ESC [
PA2	ESC]
PA3	ESC ^
TEST REQUEST	ESC }
DUP	ESC {
FM	ESC ~
NEW LINE	NEW LINE (on 912B/920B) or CONTROL
CURSOR LEFT	LEFT ARROW or BACK SPACE (on 912C/920C/950)
CURSOR DOWN	DOWN ARROW or LINE FEED
CURSOR UP	UP ARROW
CURSOR RIGHT	RIGHT ARROW
CURSOR SELECT (Light Pen)	CONTROL T
Screen Refresh	CONTROL B
Status Display	CONTROL C

*nn = 2 decimal digits (01 through 08) which defines the target device.

Option switches should be set as follows:
UDUUUUDUXX (S2 on 912/920);
XXXXUUXXXX (S1 on 950), UXUDUXDUXX (S2 on 950)
U = Up
D = Down
X = Don't care

APPENDIX C

BEEHIVE DM5A

	FUNCTION	KEY (OR SEQUENCE)
	CLEAR	CLEAR
	DELETE CHARACTER	DELETE CHAR
	ENTER	RETURN
	TAB	TAB
	BACK TAB	BACK TAB
	RESET	RESET
	HOME	HOME
	ERASE INPUT	CLEAR EOP
	ERASE END OF FIELD	CLEAR EOL
	INSERT MODE	INSERT CHAR
	PF1	PF1
	PF2	PF2
	PF3	PF3
	PF4	PF4
	PF5	PF5
	PF6	PF6
	PF7	PF7
	PF8	PF8
	PF9	PF9
	PF10	PF10
	PF11	PF11
	PF12	PF12
	IDENT	PF16 nn*
T E/S 3	COPY	PAGE SEND
	PA1	PF13
	PA2	PF14
	PA3	PF15
	TEST REQUEST	AUX SEND
	DUP	ALT D
	FM	AUX ON
	NEW LINE	ALT J
	CURSOR LEFT	LEFT ARROW
	CURSOR DOWN	DOWN ARROW
	CURSOR UP	UP ARROW
	CURSOR RIGHT	RIGHT ARROW
	CURSOR SELECT (Light Pen)	ALT T
	Screen Refresh	ALT V
	Status Display	ALT A
r E/S N	LOCAL	
E/S n	ONLINE	

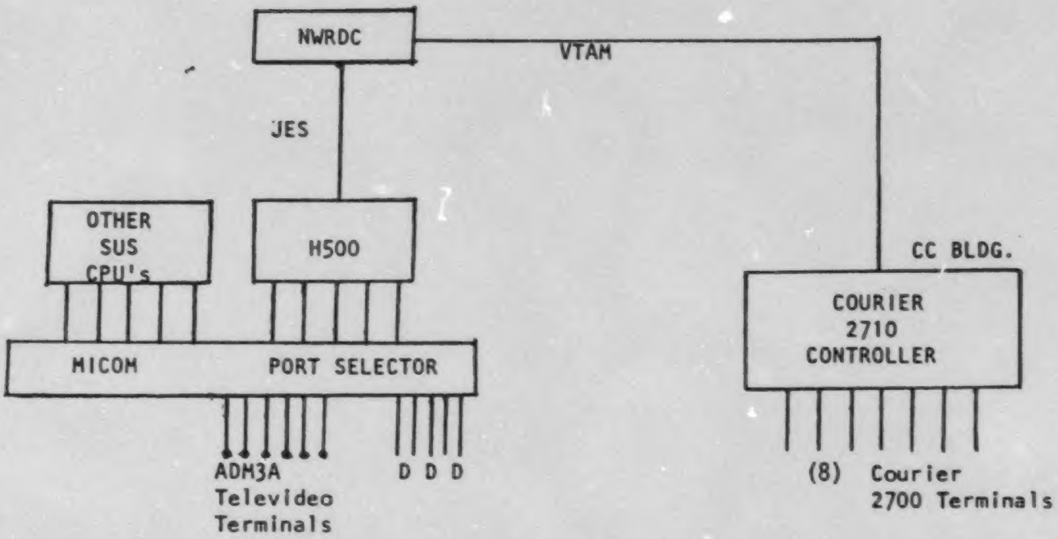
*nn = 2 decimal digits (01 through 08) which defines the target device.

The terminal should be in character mode, full duplex, and set for 7 bits plus a mark (always 1) parity bit data and one stop bit.

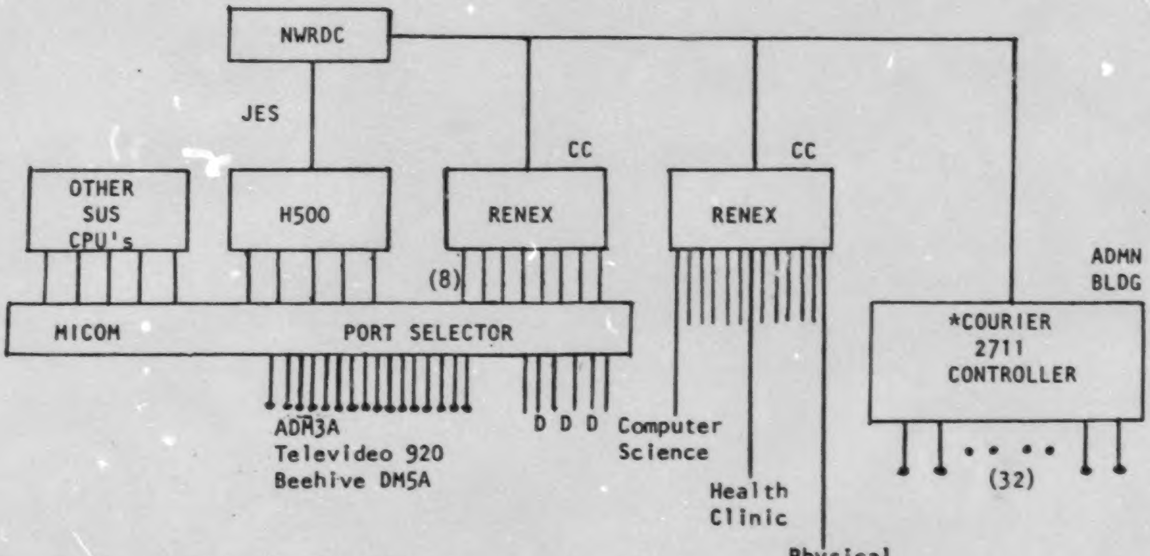
The internal switch which sets all single key ESC sequences to be local/transmitted should be in the off position.

APPENDIX D

BEFORE RENEX IMPLEMENTATION


NWRDC
VTAM
JES
OTHER SUS CPU's
H500
CC BLDG.
COURIER 2710 CONTROLLER
MICOM
PORT SELECTOR
ADM3A Televideo Terminals
D D D
(8) Courier 2700 Terminals

AFTER RENEX IMPLEMENTATION


NWRDC
JES
CC
CC
OTHER SUS CPU's
H500
RENEX
RENEX
(8)
ADMN BLDG
*COURIER 2711 CONTROLLER
MICOM
PORT SELECTOR
ADM3A Televideo 920 Beehive DM5A
D D D
Computer Science
Health Clinic
Physical Plant
(32)

NWRDC - Northwest Regional Data Center
SUS - State University System
* - 2710 Controller was upgraded to handle up to 32 ports

APPENDIX E

Equipment Purchased		Equipment Relocated	
Renex PCC	$ 7,800	ITT 2710 Controller	$ 2,850
(6) ASCII Terminals	$ 3,780	(8) ITT 2700 Terminals	$14,800
(1) Epson MX80 Printer	$ 750		
	$12,330		$17,650

Net Saving +$5,320

Estimated Current Equipment Prices

ADM3A	$ 525	IBM 3278	$3,050
Televideo 920	$ 675	IBM 3271	$4,735
Televideo 950	$ 650	IBM 3276	$6,300
Beehive DM5A	$1,045	ITT Courier 2700-3	$1,850
Beehive DM78	$1,250	ITT Courier 2710	$2,850
Okidata 82 Printer	$ 480		
Epson MX80 Printer	$ 750		

Renex - 8 port	$ 6,950
Renex - 16 port	$10,950
Renex - 24 port	$14,950
Beehive CC76 - 8 port	$ 5,625
Datastream T7CM 8 port	$ 9,700
Datastream T7CM 16 port	$15,950

APPENDIX F

BENEFITS EXPERIENCED

1. Allowed more effective use of existing ASCII terminals.

2. Via the MICOM Port Selector, obtained more effective use of existing VTAM ports. A population of 16 ASCII terminals are now using 8 VTAM ports.

3. Hardcopy printers are now available to programmer/analyst for screen development and documentation.

4. Through the dial-up facilities, branch campuses via FX lines to the main campus can inexpensively access on-line information. Programmers/analysts may also dial-in from their homes for full screen VTAM support.

5. Cost effective for hardware acquisition and maintenance costs.

APPENDIX G

PROBLEMS EXPERIENCED

1. Adjustment period required for programmer/analyst to get use to keyboard operation.

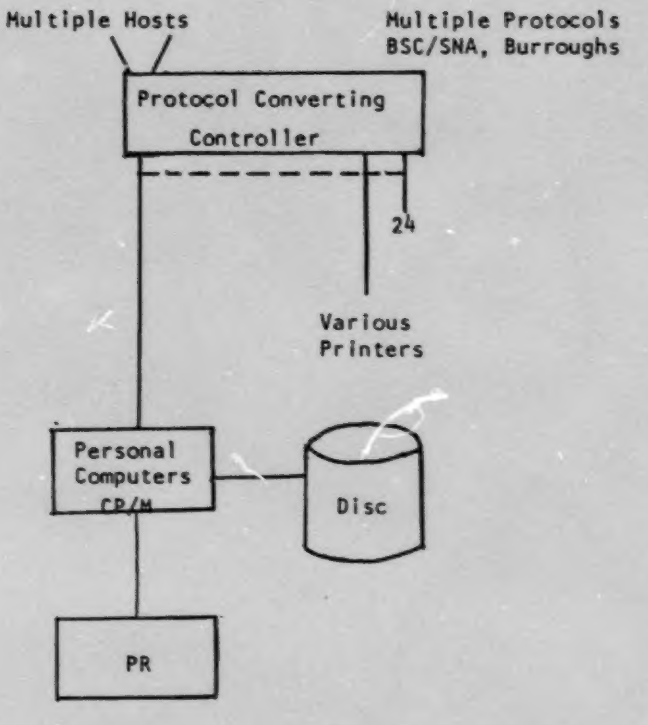
2. Maintaining different ASCII terminals and synchronous terminals creates programmer/analyst and user cross reference problems.

3. Qualified technical support staff needed to ease installation problems (i.e. proper terminal strapping).

4. Dropped phone connections, creates security risk. Appropriate host system software fix is not readily implemented.

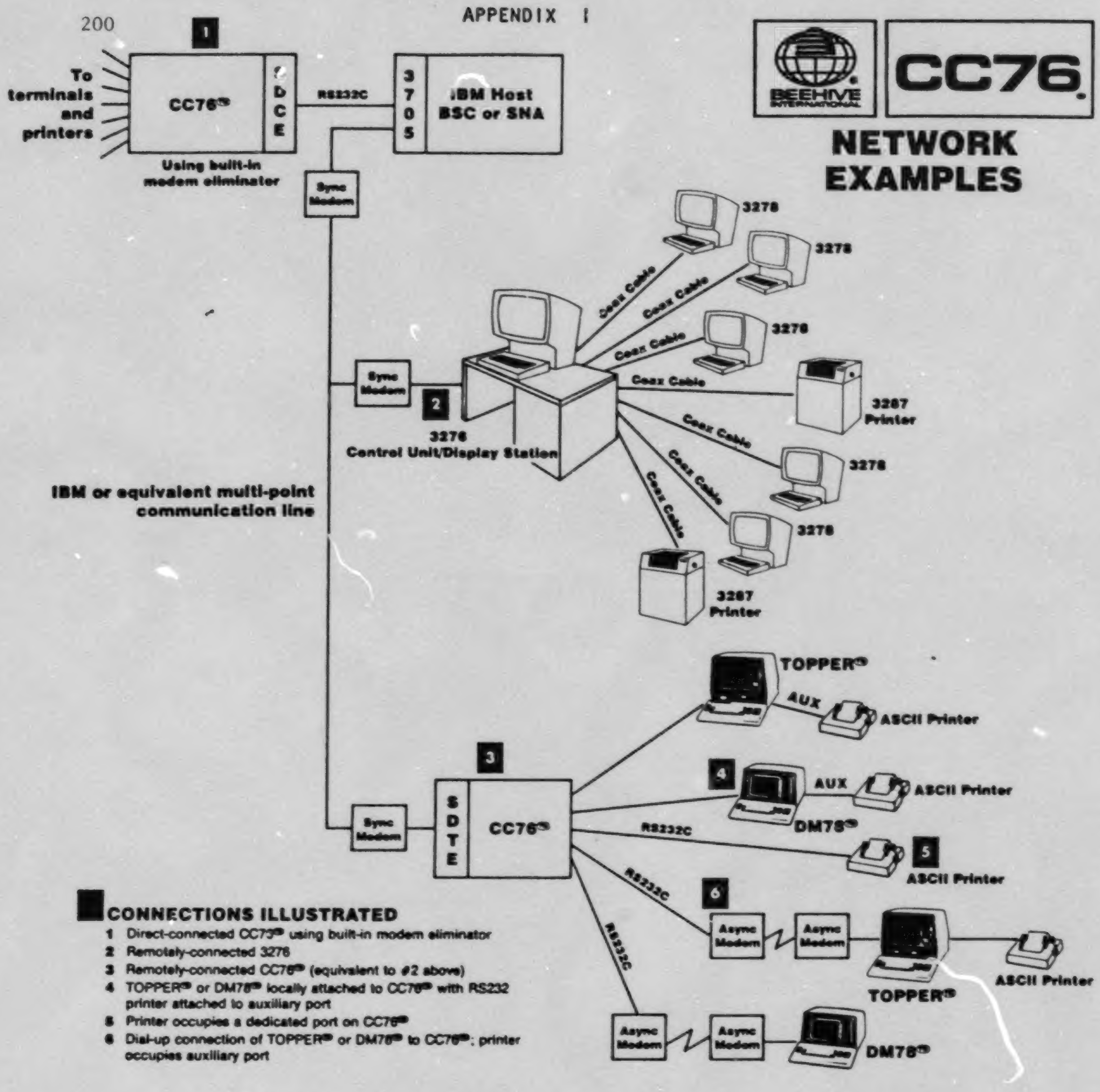
APPENDIX H

ADVANCES


Multiple Hosts
Multiple Protocols
BSC/SNA, Burroughs
Protocol Converting
Controller
24
Various
Printers
Personal
Computers
CP/M
Disc
PR

CC76

NETWORK EXAMPLES


1
To terminals and printers
CC76
DCE
Using built-in modem eliminator
RS232C
3705
IBM Host BSC or SNA
Sync Modem
IBM or equivalent multi-point communication line
Sync Modem
2
3276 Control Unit/Display Station
Coax Cable
3278
3287 Printer
3
Sync Modem
SDTE
CC76
TOPPER
AUX
ASCII Printer
4
DM78
RS232C
5
6
Async Modem
Async Modem
Async Modem
Async Modem
TOPPER
DM78

CONNECTIONS ILLUSTRATED

1 Direct-connected CC73® using built-in modem eliminator
2 Remotely-connected 3276
3 Remotely-connected CC76® (equivalent to #2 above)
4 TOPPER® or DM78® locally attached to CC76® with RS232 printer attached to auxiliary port
5 Printer occupies a dedicated port on CC76®
6 Dial-up connection of TOPPER® or DM78® to CC76®; printer occupies auxiliary port

CC76™ SPECIFICATIONS

COMMUNICATING MODES
IBM BSC, IBM SNA/SDLC
ASCII Asynchronous

COMMUNICATING PORTS
One Synchronous Host port
Eight Asynchronous Remote Ports

SIZE
4" H x 16.75" W x 20.5" D

WEIGHT
12.4 lbs.

POWER REQUIREMENTS
117VAC or 240VAC, 100 W

BAUD RATES
Synchronous: 9600, 4800, 2400, 1200
Asynchronous: 9600, 4800, 2400, 1200, 600, 300, or 150

BEEHIVE DISPLAY TERMINALS SUPPORTED

TOPPER® Personal Computer
DM78® CRT Terminal (IBM 3278 Emulator)
DM310® CRT Terminal (IBM 3101 Emulator)
DM5® Low-cost ASCII terminal
Each port works with multiple terminal types

FIELD SELECTABLE OPTIONS
Printer Support
Disconnect: Auto, Timeout, and Inform
Keyboard Lock Inform
Terminal/Printer Type Support
Parity, Stop Bits, and Baud Rates
DTE/DCE Interfaces for each port
Flexible Modem Support
Self-Test and Monitor Modes

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The Fourth Generation of University Administrative Data Processing

THE BRANDEIS SOLUTION

Charlotte Davis McGhee, Director, Management Information Systems

Background

Brandeis University is now completing the implementation of a new information system using a fourth generation language which promises to change radically its administrative data processing environment. The University's needs were not unique nor was the dissatisfaction with the existing systems. Brandeis administrators were devoting excessive time to problems of gathering information. They were focusing their effort on the complexities of that process rather than on the issues. It had become increasingly clear that the ability to plan for the future was severely hampered by the inability to define and control the present. There was general agreement that administrators, faculty and students were poorly served. However, we all know that general agreement that something needs to be done does not guarantee that something will happen. This paper has a two-fold mission - to discuss an exciting new product that will facilitate the management of the life cycle of new applications and to describe in some detail how the decision-making process was managed.

The conscious development by an organization of a new model for making a decision does not happen accidentally; there must be a high level of dissatisfaction with what has gone before to evoke such a response. By definition it is a process that is highly disruptive of traditional power and influence patterns; in practice it is time-consuming and the cause of great anxiety. Brandeis University was responding to an ever growing list of application needs. It was about to launch a major capital campaign which was ill-served by a batch system that captured name, address and gift information in a most rudimentary fashion. The circa-1965 batch accounting system could not support management information needs and was increasingly deficient in meeting the changing reporting and control requirements. The data processing department faced an ever growing backlog of program requests with the concomitant rising dissatisfaction in the user community. Turnover in programmers was high as the escalation of salaries in the for-profit sector lured those with any experience.

Successive generations of programmers coped with 2500 programs specified by successive generations of administrators written for one computer and converted to another with almost no documentation by either the requestors or the providers. An ever increasing percentage of the university's resources were being used to manage the problem leaving less and less to search for the solution.

It was to have been different. Several years earlier the University had installed a new computer. That decision bought time but little else. As the changing environment of higher education called for new rigor in the management of scarce resources, it also called for new decision models. The President, nearing the end of his term of office, resolved to improve the situation for his successor. In 1981 he established of Office of Management Information Systems with the mandate that it develop a comprehensive strategy. This mandate extended into every aspect of management, for he understood well that the design of new systems and the development of management capabilities must proceed concurrently. A Management Policy Committee composed of the Dean of the Faculty, the Vice-President of Administration, the Vice-President of Finance and Treasurer, the Budget Director, and the Dean of the College was formed to guide the effort.

The scene was set. Several critical factors for making innovative decisions were present: top level commitment, external pressure, high level of need, widespread dissatisfaction.

The Decision-Making Conceptual Framework

Defining objectives is always less difficult than devising a strategy of how to get from here to there. No decision so agonizes the academy as one concerned with data processing. Evidence demonstrates that this is true regardless of the size of the institution, its style of management, public or private, the stage of development of its data processing, the cast of characters involved. We have all heard the tales of horror, there is no need to repeat them here. The process is not only costly in actual resources spent, but also consider the price of lost opportunity. The lack of proportion in the resources expended in these decisions is astonishing. One major university recently redefined its concept of a liberal arts education and restructured its content - a venture that involved the entire academy in negotiations. That assignment was completed within a shorter time frame than its decision to purchase a new computer.

How to structure the process of decision to give adequate comfort to the persons responsible while moving them rapidly to a conclusion became the most difficult part of the assignment. Personal experience of wrong decisions joined by tales of the misadventures of others assert themselves upon otherwise reasonable administrators imposing an overly rigorous structure on the process of data processing decisions. This structure implies that there is one best solution and only enough time and effort and information are wanted to discover it. Of course, successive decisions that fail to meet expectations are attributed to a lack in one of the three components, which is remedied by more of the same. We are thus projected into expensive time-consuming searches that are so concerned with being risk-free that the best solution would undoubtedly be rejected if in fact it could be discovered.

We found our model in the early writings of Herbert Simon who said that administrative man did not seek to maximize but to "satisfice." March & Simon, p.261 There are never enough resources nor time to discover and weigh all alternatives. We have multiple goals and at any given time a solution might be rational in the pursuit of one of them while at the same time irrational in the pursuit of another. In any case, we are not intellectually capable of defining what is perfect information, collecting it, and correctly assigning utility to each alternative. Administrative man therefore seeks a satisfactory solution rather than the one best solution.

> "An alternative is satisfactory if: (1)there exists a set of criteria that describes minimally satisfactory alternatives, and (2) the alternative in question meets or exceeds all these criteria. Most human decision-making, whether individual or organizational, is concerned with the discovery and selection of satisfactory alternatives; only in exceptional cases is it concerned with the discovery and selection of optimal alternatives...To optimize requires processes several orders of magnitude more complex than those required to satisfice. An example is the difference between searching a haystack to find the sharpest needle in it and searching the haystack to find a needle sharp enough to sew with." March & Simon, pp140-1

It may not sound convincing, but it was a major breakthrough when we were able to agree that we would so limit our search, that at each decision point we would stop once we had found a satisfactory alternative. The model informed each step of the decision process beginning with the articulation of the four premises.

(1) The first premise was the inevitability of imperfect communication between administrative and data processing personnel. Administrators must carefully communicate their goals and objectives to data processing professionals in order that these goals and objectives be incorporated appropriately into the technical product.

The administrator is the most important person in the defining of system needs. Administrators are not uniformly capable of anticipating the way in which they and their functions will respond to a new system. Definition of need changes as much as a result of experiencing a new system as from imperfect conceptualization. A good solution would be responsive to this fact of life.

(2) The second premise was that to arrive at a decision within a reasonable time frame, we would have to deal with the high level of uncertainty that surrounds data processing decisions. This uncertainty is partially caused by the rapidly changing environment. Such decisions can only be judged within the time frame in which they were made. In addition, since the nature of the problems which dp decisions are called upon to solve are evolutionary in nature, the decisions are made with two, not one, moving targets. There is a very human fear that today's decision will be obsolete tomorrow. This is usually expressed

by an overly extensive study of "everything" available on the market. Progress required recognition that, in many cases, there would be no definitive answers.

(3) Our third premise was that the new system must include the needs of top managers. Unlike earlier data processing decisions which focused on the needs of operations managers, the new configuration would add the needs of top level management. These needs require significantly different information support structures. Specifically they require the ability to have access to data sufficiently integrated and timely to support spontaneous questions in a world of changing requirements and objectives.

For a long time the needs of top management had been largely ignored because the technology to support them was prohibitively expensive. Gorry and Morton, in writing about this, have noted that with the advent of large minicomputers and database architecture, new systems can be built that dynamically involve the manager's judgment and support him with analysis, models, and flexible access to relevant information. Gorry and Morton, p.2 The Management Policy Committee anticipated that this new agenda would create tension between top management and the persons in charge of operations who would view this as intrusion into their area.

(4) Our fourth premise was that universities could not hope to compete with the private sector for the limited number of competent programmers available. Indeed, even corporate America seeks ways to extricate itself from the price competition for this resource. Warren McFarlan of the Harvard Business School has written, "The scarcity of trained, perceptive analysts and programmers, coupled with the long training cycles needed to make them fully effective, has been the chief factor restraining CBIS Computer Based Information Systems:data processing development in the companies we studied." McFarlan, p.78 James Martin says that if we assume no increase in programming productivity, he estimates the industry will need 93.1 times as many programmers as now. "There are approximately 300,000 programmers in the United States today. That suggests about 28 million programmers in 10 years' time." Martin, p.2 Non-people solutions were clearly required.

Here you have the four premises that guided our effort: the inevitability of imperfect communication, the existence of uncertainty due to a rapidly changing environment, the necessity of including management information needs with those of operations, and the scarcity of data processing professionals. Within this framework the Management Policy Committee made the following decisions:

-to move as quickly as possible from a batch-oriented data-processing environment to an on-line database environment;

-to provide a query and reporting capability that would deliver timely responses to spontaneous questions;

-to move access to the information on the system out to the users (to the extent desired by management and under strict security controls);

-to eliminate as much as possible user dependence on the data processing staff;

-to implement as quickly as possible an integrated university development system, an integrated accounting system - begining with the general ledger and accounts payable in the first year - and a new student records system.

A task force for each of the three systems was appointed and weekly meetings were held to develop design specifications. At the same time, at the suggestion of the President of the software company working on the development system, we began to look at the tools available to improve productivity, to explore the world of fourth generation languages.

The Hardware Decision

The preliminary specifications for the Development system were ready in May, 1981. We had first intended to upgrade our existing computer but several factors caused us to reconsider. The first addressed transaction-oriented versus program-oriented software design. The existing computer environment was most appropriate for iterative, highly structured processes that required little user decision capability in the jagon: transaction oriented design. Program-oriented designs are more appropriate for systems we sought where spontaneous questions are likely to be asked, where the elements of a record have multiple relationship combinations.

Second, the question of hierarchical versus network or relational database design was raised. The existing computer supported only simple relationships between records; it basically employed a hierarchical structure which means that there are parent-child-grandchild relationships established and there is only one way into the data. This makes it much harder to describe complex relationships that may have multiple hierarchies. A network or relational data base structure imposes no such limit. It makes it possible to get into the database at any of several points. This is especially important in the development system where name, geographical location, class, industrial affiliation, etc. are equally important ways of accessing a record.

Third, MIS noted the old system's complicated inquiry software which was unsuited for general users, very powerful but complicated. It was not designed for time sharing since every user required a full copy of the program, a problem that could only be overcome by writing a new inquiry program.

Fourth, the lack of data compression capability was noted. By nature a development system has a wide variation in the amount of information to be stored on each record. Without data compression such a system is very costly.

Finally, an extensive search of other college and university systems revealed few had a similar hardware installation. Those university software systems that had been developed for its use were batch rather than on-line. Vendors of software packages were either uninterested in modifying their packages for that computer or quoted very high prices because of the lack of a market for further sales. It became apparent that we would be on our own in a number of ways. Software costs would be greater because few universities have installed this computer. Similarly, costs of professional people and consultants would be higher.

The Management Policy Committee was sufficiently impressed with the questions to ask for information on hardware alternatives. Several technical consultants were brought to the campus for discussions of the various issues. Some of their comments were especially compelling. The existing computer environment had all of the complexities of the mainframe without the power of the newer designs; that is, a complex operating environment without much reward. The newer designs provided many more functions in the system software, some of which were crucial in the systems Brandeis needed. One consultant likened pioneering with the existing computer to going to the North Pole: there are not many with you. He likened pioneering with the newer computers to the Westward Movement: you are part of the wave of the future. We spent several months examining different equipment. We began with an analysis of the requirements of the Development system with the need for a system capable of handling 200,000 records and a database of 400 megabytes of data. Added to that were the requirements of the accounting system and the student records system, and, in less detail, the requirements of the twenty-three other proposed systems. Hardware and system software needs were defined as follows:

1. 2 million bytes of memory initially
2. 600 million bytes of disk storage initially
3. 650 line per minute printer
4. 1600 BPI mag tape drive
5. 64+ terminal capacity
6. RPG and COBOL compilers
7. Network or relational database
8. Program rather than transaction oriented
9. User friendly inquiry facility
10. Interactive environment with shared programs
11. Not require an in-house system engineer to operate.

The Management Policy Committee found it relatively easy to move away from the existing computer. What to move to was more difficult to decide. The move to a large mainframe computer was quickly rejected because of the high operating overhead of such an installation. Within the minicomputer world, four options were explored extensively. Guidelines for review included how well the system met the above requirements, price, delivery, ease of programming, user friendliness, ease of conversion from our current system to the new system, satisfaction at other user sites, software and hardware maintenance, and support reputation. The University purchased a large minicomputer that has the capacity to handle all of the Brandeis applications for the foreseeable future.

I am ever dismayed at the inordinate amount of time and energy that go into most hardware decisions. Institutions tend to become immobilized with what one person has described as "hardware hypnosis." We spent several hundred man hours on the subject. Were they necessary to make the correct decision? Probably not. Were they necessary to make people comfortable with the decision? Probably were. It is certainly true that I receive more questions about this part of the decision than I do about any other. The fact is that once we had established the aforementioned guidelines, there were four reasonable ways to go none of which were perfect and none of which were bad. The cost differences were insignificant.

The Applications Software Decision

Brandeis had been looking for software application packages for some time. They had identified a development system that met that offices design specifications. They had determined that there was no interactive fund accounting system in a database environment suitable for a complex university with about 20,000 accounting transactions monthly and 400 sponsored research projects with an annual budget of over 18 million dollars to manage. There were several interactive database student records systems, but each would require significant modification to support Brandeis practice.

We looked carefully at the several integrated college administration packages available for smaller computer installations. The price was right but unfortunately none could support the size and complexity of the Brandeis systems.

Once we determined that we would have to hire a software firm to write accounting and student records systems as well as the development system we knew that we had to find some way to build on the process so the subsequent system development assignments would be less costly. We not only sought a methodology that would allow us to build on each application but one that would ensure that the end result of our efforts would be a truely integrated system. This approach also permitted us to take maximum advantage of those cost-savings available through the standardization of program development. To this end the Committee determined that a methodology for the development of all systems be designed and incorporated into the system software of the new computer. Thus we entered the fourth generation.

And what a world it is. There are on the market today, hundreds of software development tools and techniques, query languages, report generators, application generators, and very high-level programming languages. We did our homework. James Martin's books were circulated and read. We didn't want much. Our ideal product was one that would perfectly capture users wishes, anticipate changes, design screens, write code, optimize, maintain, document and train, preferably without human intervention.

We had to settle for less, but not much less. We purchased a product called FAST that does provide a complete set of automated tools for system development, maintenance and management. It's comprehensive. There are seven modules which are integrated through a design database which collects user specifications for the system's design and implementation. Its's flexible. We were able to establish for each project standards and procedures suited to Brandeis management style and needs. It is relatively easy to use. Within the two-day training criteria established by Martin, it is possible for the non-technical user to learn how to design and implement screens in the prototype mode. In other more difficult aspects, users are encouraged to get involved. Data processing professionals are supported in all aspects of their jobs and have become more effective. Work with FAST typically begins using the prototyping module. This allows us to build a model of an application and permits both users and developers to work with the system. This is one of FAST's greatest strengths. It provides the user with the tools necessary for them to actively participate in the design process. It eliminates to a large degree the imperfect communication problem earlier discussed. The user no longer specifies screens to the DP professional; he specifies them to FAST. The DP professional is no longer the bottleneck but the facilitator, assisting the user, moving him through the process. For all intent and purpose, the we/they distinction disappears.

In the prototype mode the user can experiment and modify until satisfied with "his" product. This experience with an interactive on-line system educates the user about the new environment which evokes changes in his way of thinking about his needs very early in the life cycle.

The time lag between specification and seeing something happen is miraculously contracted maintaining user attention and interest and satisfaction at unusually high levels. To give you an example of what can be done within the prototype framework, the Brandeis Development system has fifty-three screens, the smallest of which has twenty-five fields, the largest, over one hundred. They were implemented in FAST prototype by non-technical people within a two month time frame. A screen can be designed and implemented almost as quickly as it can be conceptualized.

Nor is the prototype model to be discarded. The beauty of FAST is that nothing is wasted - it meets our highest expectation of integration. Each succeeding phase of the life cycle builds on its predecessor. The design moves into the prototype and the prototype is modified and improved until finally the user says "I'm satisfied". At this point the prototype becomes the system.

FAST uses both procedural and non-procedural descriptions to build systems. Nonprocedural descriptions tell what is to happen rather than how or when. Procedural descriptions are more demanding. You must say what, when, and often how. As a result, users can quickly specify their procedures non-procedurally, while a more trained person is needed for a procedural one. While the FASTDEMO module is nonprocedural, it is not rigidly so. It is possible to move to FASTCODE - which is a procedural language in the prototype phase, to achieve full functionality. The nonprocedural support can be extended, if needed, to cover that case. A good example is a special edit test. The first time it is described it is procedural and needs FASTCODE. But if it is used widely, it may be made non-procedural. Forever after it is non- procedural - the user need only specify the edit test and FAST provides it. A programmer is no longer needed to provide it.

Earlier I mentioned that a goal of the new system would be the ability of successive projects to build upon what preceded. Think for a moment about this interplay between procedural and non-procedural components. Each new application will call upon FASTCODE for those portions truly unique to it. Components common to many systems, once defined, will reside in the non-procedural library, ready for user implementation. Think about the the various units in university accounting systems and you will begin to realize the power of FAST.

FASTCODE is a high level structured language. It can transition between prototype and production. Together with other information in the design database it can be used to generate code in other programming languages, to very high standards.

FASTCODE is used at the boundaries, it is the tool that extends the range of the application, that explores new territory. It is here that "how to do it" is determined, that optimizing occurs.

Other FAST tools help in managing project workload, program testing, system control during development and after installation and writing documentation. It is impossible to do justice in the time allowed to its many aids in improving productivity while improving the quality of the product provided.

In summation let me say that university data processing has moved beyond the needs of operations to those of top level management. These needs cannot be prespecified. They need an information support structure that provides access to data sufficiently integrated and timely to support spontaneous questions in a world of changing requirements and objectives. This is best supported by an interactive on-line system with either a network or relational database. To meet these needs the level of productivity of data processing professionals must be improved. Very high level programming languages such as FAST provide an integrated set of tools that are needed if we are to overcome this problem.

Martin Buber has written that "one does not learn the measure and limit of what is attainable in a desired direction otherwise than by going in this direction." Buber, p.206 Brandeis University has determined that the time to incorporate the fourth generation is now. I started this paper with the word "radical", that this will radically change our data processing environment. I conclude with the observation that it is in reality the conservative solution if we are to meet the needs of the eighties.

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A SNAPSHOT OF EFFECTIVE COMPUTER TECHNOLOGY IN COLLEGES AND UNIVERSITIES IN ILLINOIS

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A report of the effective computer practices of the Colleges and Universities of Illinois highlighting the computer applications, but more importantly the reasons for their effectiveness. Identifying the relationship of the user with the computer and how the work of this relationship is effectively accomplished.

METHOD

A letter and questionnaire were mailed to 238 colleges and universities in the State of Illinois on September 9, 1982. Eighteen forms (7.6 percent) were returned and used in the analysis. No attempt was made to increase the response.

ANALYSIS

The responses from the Directors were transformed to sheets where each response could be compared to all of the responses for each question on the form. Based on the first question, "Please describe the technology or technique you are using," it was determined that five categories of response were apparent. Table 1 presents the categories into which the responses were placed for further analysis.

TABLE 1--Categories of Response

Service Bureau
On-line Systems
Academic Systems
User Oriented Application Development
Do Not Use Computers

The Technology Or Technique Being Used--Table 2. There are institutions that do not use the computer for administrative computing. Those respondents did indicate, however, that the computer was being considered and that they would be interested in the results of the survey. No further analysis of the responses from these institutions will be reported.

Three responses indicated that the service bureau role is a viable option for some institutions. One institution each provided a service bureau service, used another university service, or used a profit making firm. No further analysis for this category will be reported.

TABLE 2--The Technology or Technique Being Used

On-line Systems
    On-line
    On-line system for administration
    Network processing, on-line and batch
User Oriented Application Development
    User Files On-line (UFO)
    Dictionary based high-level language
    User oriented applications
    Purchased application software
    Information Center
    Application development facility
    Data entry system for the data entry source

Academic systems are not a high priority interest for CAUSE members and no further analysis for this group will be reported.

On-line systems certainly reflect the state-of-the-art in hardware and software, so it is realistic that this technology should be reported by the respondents. Twelve years ago the centers who were using this technology were being admonished for squandering the taxpayers money. It is good to see that this technology is prevailing over the wimps and witches of that conservative era.

The heart of the response to this survey is in the category of "User Oriented Application Development." Maybe some day the large centralized computer systems will really be able to provide economical, flexible, usable and efficient computer service to the users in their office, on their equipment, when they want it, at their direction, and without hours, days, and weeks of committee meetings with programmers, analysts, managers, and vice presidents setting priorities, budgets, preferences, and other "helpful" administrative rules and regulations. This category of response is what administrative computing is all about--let the user manage his office, and let the computer people provide the computer utility.

TABLE 3--Application Or Method Of Use

On-line Systems
- Enter data and run programs from offices
- All administrative systems
- Course scheduling
- Registration
- Student records
- Grade and transcript processing
- Financial aids authorization and repayment
- Tuition and fee payments
- Purchasing
- Budgeting
- Accounts payable
- Payroll

User Oriented Application Development
- Student systems
- Financial systems
- Remittance processing
- Cashiering
- Financial aids
- Inventory control
- Admissions management
- Personnel systems
- Student recruitment
- Room scheduling
- Accounting
- Admissions
- Donor processing

Application Or Method Of Use--Table 3. The application systems in this Table are familiar members of administrative computing environments. Any of them might be operational at any given installation, but it is unlikely that all of them would be operational at any one campus.

The on-line environment is making it possible for the computing organizations to provide the user organizations with a self-help

TABLE 4--What Makes It Effective

- On-line Systems
  - High-level user involvement
  - Good equipment
  - Administrative backing
  - Good backup
  - Instant data availability to authorized users
  - Immediacy of interaction
- User Oriented Application Development
  - No more card and tape data input
  - Easy to learn to use
  - Reduces specification time
  - Reduces coding time
  - Reduces impact of changes
  - Helps documentation
  - Makes users responsible
  - Eliminates finger pointing

computer utility. Later in the analysis, attention will be directed to the hardware and software that has contributed to user friendly computing.

What Makes It Effective--Table 4. Inspection of this Table shows that it is not all computer hardware and software that makes computer technology effective. Where there is a will, there is a way. There is no substitute for people with an awareness of mutual benefits and willingness to work together. Of course, reliable, responsive, effective, and attractive computer systems are vital ingredients to success.

The transfer of application development from the computer staff to the user office seems to stand out as the key to the effectiveness of a technique. Most of the problems of management of the administrative computing effort are addressed in this section of Table 4.

Application development that is user friendly requires data to be stored on a medium that can be manipulated by users from their offices. The method must be easy to learn to use, which means that it is relatively free of computer oriented jargon. Because the users

TABLE 5--What Are The Potential Problems

- On-line Systems
    - File security
    - Work stops when the computer is down
    - Need for more data entry persons
    - Security
    - Adjusting personnel to new technology
- User Oriented Application Development
    - Risk factor increase on modifying unfamiliar code
    - Demand for service exceeds resources
    - Flexibility constraints
    - Management of received data entry materials
    - Consumes additional CPU cycles compared to regular programs
    - Requires additional technical support
    - Hardware dependent
    - User personnel changes
    - Inadequate and out-dated documentation

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understand their system and will be personally developing the application, there is less need to explain the system in detail to an analyst, thus reducing the specification time. The coding requirement is more than likely performed by answering a series of questions and prompts that are displayed on a terminal by the computer. These parameters are stored so they can be used in future runs and they are interpreted by the computer each time they are used. This methodology provides documentation and reduces the impact of changes to the programs. User friendly systems obviously make the users more responsible for their application processing and at least changes the nature of the finger pointing that exists with batch systems.

If the director of the administrative computing effort is to be effective, a disk-based on-line system with high-level user oriented application development tools is a requirement.

What Are The Potential Problems--Table 5. Based on the authors thirteen years of experience as a director of computing, it must be

TABLE 6--What Special Things Should Be Done To Enhance Success

- On-line Systems
    - Buy a second system
    - Training
    - Documentation
    - Good personal relations
- User Oriented Application Development
    - Adequate review and testing before implementation
    - Limit or control exposure
    - Match application with utility
    - Provide for backup of data
    - Provide for deletion of data
    - Provide a backup transmission method
    - Establish one "expert" to assist others
    - In-house and contracted training
    - Establish conventions/standards
    - Provide test facilities
    - Clear definition of data structure
    - User training
    - Good documentation
    - Reliable software

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said that it is not clear that the potential problems reported by the respondents can be effectively overcome in the mean time between new directors.

The potential problems reported for on-line systems are traditional and surmountable. The security problems are more severe where one computer on campus is used for both administrative and academic computing.

Since the effectiveness of the newer technology relates to user oriented application development, the potential problems for this technology are more significant. Potential problems are management challenges. In situations where users develop their application systems, the management challenges are shared between the computer center and the user office management teams. It is teamwork that gets the systems up and keeps them going. This newer technology is providing the oppor-

TABLE 7--What Hardware Is Required

Appropriate Central Processor

- PDP 11/44
- Four-Phase IV/90 with 192K memory
- Modern computer system
- IBM CPU with adequate memory
- Hewlett-Packard 3000

Peripherals

- CRTS and keyboards
- Data entry system
- JES2/RJE communications
- Character printer
- Line Printer
- Adequate on-line storage
- Disk drives

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tunity to effectively share the application development process which changes the nature of the effort for the analyst to training and consulting with the user.

These new software tools require additional technical support to keep them tuned and current with the suppliers required release level. Technical support personnel are usually more expensive to train and require higher salaries. To offset these factors the center benefits from a more effective employee.

There are those who contend that user oriented application tools require more Central Processing Unit (CPU) cycles. If this is true, and if CPU cycles are in short supply, then this is a real problem. Of course, you do not use one technology for all systems. Proper analysis will determine the appropriate tool to use for each system which expands the role and relationship of the analyst and the user. It also emphasizes the need for effective use of comparative analytical tools.

Modifying unfamiliar code is a reported problem. This can be verified by the number of the programmers who have a preference for rewriting a system rather than modifying another programmers code. If there is an explanation, it seems reasonable that there must be a need to base code on documentation that is appropriate to the system being developed and that is easily understood. This being the case, programmers should be able to modify code that has been imported as well as in-house code that was developed by programmers who are no longer with the institution.

If documentation is not required as a tool to develop the system,

TABLE 8--What Software Is Required

Developmental	Application
ADRS	Customer written
CICS	User written
COBOL	
IDOS	
IMS	
MARK4	
POISE	
RAPID 3000	
RSTS/E	
SAS	
TSO	
UFO (Oxford)	

then it will always be inadequate and outdated. This must be a natural law for it is a common situation.

The current economy has affected the job mobility of computer people. Regardless, personnel changes in the computer center and in the user offices should be planned for at the time the systems are developed and implemented in order to lessen the impact at the time personnel changes occur.

Identifying potential problems is a major step in managing a successful and effective computer based information system.

What Special Things Should Be Done To Enhance Success--Table 6.

Two major themes are evident in the respondents suggestions. First is the knowledge required by the user, and then an adequate working environment.

Users require training and documentation that will give them the knowledge required in order to be effective. The training can be in-house or contracted, and should be supplemented with a local "expert" for continued assistance. Users need to be supplied with a clear definition of the data structures and the established usage conventions and standards. This will enable users to match their application with the available software tools. It was suggested that it is a good idea

TABLE 9--What Is The Effect On Your Computer Staff

- On-line Systems
  - We get to go home on time
  - More time to manage the system
  - Less time with data entry
  - Less time "fire fighting"
- User Oriented Application Development
  - Increased level of emphasis on education
  - Simplified the set-up of batch jobs
  - Provides backup of all data entry materials
  - Improved productivity
  - Productivity is improved by a factor of 10 in some cases
  - Preferred to COBOL
  - Reduces pressure on staff
  - Eases burden of operations staff
  - Eliminates the "scapegoat" role

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to limit or otherwise control the exposure of the users to the technology. The author speculates that this control was suggested to assure effective use and to give the computer personnel time to respond to device availability and balancing plus normal problem assistance.

Secondly, the users require an adequate working environment. This includes reliable software, test facilities, and adequate review and testing before implementation. If they are to be able to rely on the system they will need a backup transmission method, assistance in assuring backup of data, plus a method for deleting data from their application.

What Hardware is Required--Table 7. A variety of central processor systems were mentioned. The systems are obviously disk based. There seemed to be no significance by category of the response and no other significance is noted.

What Software Is Required--Table 8. The respondents noted a number of proprietary and hardware manufacturers software systems by their acronyms. Two mentioned customer and user written application systems. The reader will first require a knowledge of the listed software systems

TABLE 10--What Is The Effect On Your Users

On-line Systems
  More control of data and run times
  Computer becomes an integrated tool in the office
User Oriented Application Development
  Demonstrates that . . . is state-of-the-art
  Reaffirms progressive forward movement
  Faster turnaround for data entry applications
  Eliminates loss of data after entry into the system
  Rapid delivery of new application systems
  Improved satisfaction with computer service responsiveness
  Is transparent
  Quality is better for time spent in defining needs
  Some pressure moves to user to get requirements
  Seem to enjoy independence
  Initial shock of having to learn "production"

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in order to be able to assess their potential effectiveness. There seemed to be no significance by category of response or the items themselves.

What Is The Effect On Your Computer Staff--Table 9. Analysis of this Table shows a definite transfer of responsibility to the user of on-line systems and user developed applications. A feeling of pressure and burden also transfers when the user accepts the responsibility.

Improved productivity, work simplification, and preference for user friendly tools were reported. Staff development and increased awareness for the need for education were reported.

What Is The Effect On Your Users--Table 10. Directors are proud that they are progressive, that their center is state-of-the-art, and that their users recognize these facts. They indicate that some of the pressure moves to the user in system design as well as for production scheduling. Evidently, users enjoy overall satisfaction because they tend to enjoy their independence, perceive a faster turnaround for data entry applications, feel that less data is lost, and feel that the computer service is more responsive. New application systems are delivered more rapidly and the quality is better because of the time users spend in defining their requirements.

Having an on-line environment and user oriented application development tools has a positive affect on users.

SUMMARY

On-line systems and user oriented application development tools represent the current technology.

The new technology is being used to implement the traditional application systems.

Good personal relationships with the users and productivity enhancements of the new tools are the reasons for effectiveness.

The potential problems seem to be people oriented and the major ones are security, adjusting to new technologies, personnel changes, and resource constraints.

Training, backup, documentation, good personal relations, and reliable systems will enhance the potential of success.

A variety of modern computer systems using terminals and disk storage will meet the hardware requirement.

A variety of software systems are being effectively used.

The technology of this environment transfers the role of the application analyst to the user office and requires a higher level of computer technology of the computer center staff.

Users are willing to accept the additional responsibility because they feel they are in charge of their systems.

Users have a greater need for systems analysis and design education because of the role they are assuming.

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PERSONAL COMPUTERS CAN HELP YOUR BUDGET

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ABSTRACT

With the growing demand for computer resources and decreasing budgets, it has become increasingly important to manage computer resources at the central site as well as across the campus. By the addition of communications, mainframe users can download and upload between the personal computers and the mainframe. In effect, distributive systems represent a DE FACTO configuration. With the appropriate software and a printer, the personal computer also serves as a word processing unit. Thus, the decentralized system is justified both from the system information processing requirements and word processing benefits.

Capacity planning and resource utilization require an analysis of functional needs, resource availability both at the central site and the user site, and symbiotic affects. This paper describes a planning technique, the mission justification document, and the evaluation procedures that were developed at Central Michigan University to ensure the orderly growth of computer dependent resources within the constraints of budgets.

PERSONAL COMPUTERS CAN HELP YOUR BUDGET

Like the vast majority of schools today, Central Michigan University is facing an increasing demand and reliance on its computer resources in both the administrative and academic functions of the University. We experience both the benefits and the problems of a school which has approximately a 16,000 student enrollment of which over 6,000 live on campus. The 860 acre campus contains 19 academic buildings. Computer resources are called upon to provide services for more than 650 faculty and nearly 300 administrative personnel. Being located in a town of 22,000, off the beaten path, has affected our choice of both hardware and software.

Figure 1 highlights the changes in the configuration of CMU from 1974 to present. The most significant jump is seen in 1980 when the decision was made to establish the UNIVAC as the administrative computer and introduce the Control Data CYBER as the academic computer. Both of these computers are housed in a single facility and are under the control of the director of computer services. This organization provides centralized service to both the academic and administrative units.

The separation of the two computers was followed by a very rapid growth in the use of communications. In the administrative area it was clear that many of the applications systems could be functionally more servicable if they were available at the user's desk. On-line applications became the by-word of the administrator. Where formerly one could overhear discussion of punched cards, now one hears discussion about bringing up the screens. Utilization was encouraged farther by the installation of the DMS/data base system and CMS communications. However, with this growth came two other factors. One was the desire of the administrators to have greater control of their data. Microcomputers and minicomputers appear to provide an answer in that case. The second was the rapid growth of word processing. Although formerly available on special machines, it began to look as though one could have the same capability for a little extra cost on a small computer. This appeared rather attractive to administrators.

In the academic area we found other motivating forces. Computer literacy on a campus-wide basis was encouraged both through the introduction of new courses and special courses for the education of faculty. The advent of terminals increased faculty awareness of what could be done with the computer. The computer facilities were severely taxed in trying to keep up with some of the requirements of individual faculty who desired to do specialized research. Requests came for simulation packages, analysis packages, functional packages, databases, etc. Faculty showed little regard for how these requests affected available resources.

It became increasingly clear that from the academic point of view the computer was being used in several different modes:

(1) as a means of analyzing complex data and performing involved computations,

(2) as a means for storing large files of data which can be accessed and utilized in research,

(3) as a means for storing programs which students could use in solving their problems,

(4) as a means for teaching by using simulation and interactive methods,

(5) as a means for teaching business application of computers,

(6) as a means for teaching programming, data structure, and logical design.

An analysis of the ways in which the computer was being used revealed that it is not necessary to have a large powerful computer in order to accomplish all of these academic applications. Clearly, some of these applications could be accomplished on personal computers or on minicomputers. In fact, an analysis based on a simple breakeven approach shows that for appropriate conditions it is less expensive to provide service via personal computers than by adding additional terminals to a central site. Figure 2 shows a breakeven chart in which the cost of supplying a service versus the number of service units that are available is plotted. The service unit in this case represents a terminal, modem, and communications interface. Alternatively, a service unit can be represented by a personal computer including a display and printout capability. It should be noted that in dealing with a personal computer we assume that not every station contains its own printing capability. This is consistent with the analysis since not all terminal stations contain an individualized printing capability. It is also consistent with the general practice since on a central computer facility, one normally would route their output from the terminal to a central printer or an RJE site printer. Analogously, with personal computers it is possible to have some of the systems equipped with a printer and use this to print from compatible diskettes.

The Line T_1T_2 demonstrates a linear increase in cost as a function of the number of terminal type service units. The line P_1P_2 represents the linearly increasing costs as a function of the increasing number of personal computer service units. We know that the increase in the number of terminals depends on the capability of the mainframe to accommodate the load. At some point, it becomes necessary to upgrade the central system. The spike increase will vary as function of the type of upgrading required. In some cases it may be just a matter of adding several ports, or it may involve the addition of complete new units. Changes in configuration may be accompanied by increased memory, storage, or other resources. Once the spike is passed, the cost of adding additional terminals is given by a line which has the same slope as it previously did. Note that the addition of a personal computer at the outset will be more than the cost of a terminal, and furthermore each additional personal computer will cost more than each additional terminal (i.e., the slope of the personal computer line is greater than the slope of the terminal station line). However, between the points S_1 and S_2 the actual costs of personal computers is less than the actual costs of adding additional terminals because of the associated equipment that must go with the terminal.

The application of this model will vary from installation to installation. Figure 3 shows the academic computer installation at CMU. At the time of these deliberations it was already planned to increase the central memory from 130 K to 196 K words. Other changes were also planned in terms of upgrading the equipment to meet the increasing service requirements on campus. The Network Processing unit supports four RJE stations which serve students at three different locations. It also supports 124 asynchronous interactive terminal ports from the Gandalf Data Switch. The Gandalf accommodates 16 dial-up lines and 108 hardwire terminal lines. An increase in the number of lines to the Gandalf is responsible in part for the spiked budgetary increase. We also had to seriously consider whether the number of interactive ports would provide us with the service that was required. Figure 4 illustrates growth in the use of CPU as we increase the number of terminals and of computer resources. This S curve is generally viewed as a long term trend.

A fundamental question that was of concern was "Can PC's satisfy the needs of the department?" The users are spread over 37 departments. An examination of the use statistics indicates that within the academic sector the ways in which a computer is used varies significantly. The Computer Science curriculum is classical whereas the Information Systems curriculum is business oriented and similar to the DPMA recommendations. Figure 5 shows the difference between the way the computer is used by students in the two departments. A session refers to the time between sign on and sign off. As the semester progresses, students in both Computer Science and Information Systems tend to increase the amount of time per session. However, a more interesting feature is revealed by CPU used for each session. In Computer Science, at the beginning of the semester, programs are relatively simple; consequently, the amount of CPU time used is comparable to that used in the business courses. However, by the end of the semester the CPU per session used by Computer Science students more than doubles, whereas for business students the CPU usage increases about 15%. In fact, the Computer Science students on the average will be using twice as much CPU time as an Information Systems student based ratio of CPU seconds per connect time. A similar analysis of faculty utilization suggested the same differences in utilization between members of the Math, Physics, Chemistry, or other science departments as compared to Finance, Accounting, or other business departments. Although this may not be new information to people who deal with computer utilization in an academic environment, it serves to point out that the computer needs of the business school may not generally best be served by a central computer which provides computational capability and number crunching. The analysis indicates that CPU speed has less effect on business students than on science students.

An analysis of student utilization of storage reveals that only approximately 10% of the students in the business curriculum that utilize the computer would need significant storage space. Further examination indicated that essentially the same parameters hold for students in the Computer Science program. This leads us to the realization that personal computers could readily serve a number of students in the entry and medium levels.

In considering expansion of computer service by increasing personal computers, it was important to consider faculty utilization. A telephone survey of approximately 20 faculty members revealed that the personal computers were used for record keeping of a personal nature, word processing type of applications, lesson preparations, and checking small test problems. To a relatively small extent did the owners of PCs find it necessary to use the central facility. However, when they did, it was clear that a communications attachment to the PC would serve to answer their needs. Figure 6 is a list of the service factors that faculty considered important. It is interesting to note that on this list we do not find the requirement for complex computing power and high speeds. However, that requirement becomes evident when we look to the users of the central computer rather than the users of the personal computer.

Breakeven calculations show that PCs can be economically justified. Utility theory using a marginal analysis reinforces this finding. Figure 7 shows the type of curve that results from plotting utils vs. cost, where util is a measure of personal satisfaction and service. As the number of service units increases, the value in terms of utils to the user community increases at a rapid rate, up to a certain point, and then begins to fall off. This is illustrated by the curve for terminals. Because of the many other functions to which it can be applied, the value of the personal computer in terms of utils rises more rapidly than the terminal value. However, the cost of PCs also increases more rapidly than the cost of terminals. Figure 7 shows that for a portion of the curves, the differences between C_1 and V_1 are less than the differences between C_2 and V_2. The amount that V_2-C_2 exceeds V_1-C_1 is essentially the marginal profit that the institution is garnishing in terms of utilization of its resources. Consequently, if the funds are available, even though the cost of PCs exceeds the cost of terminals, the return to the institution is higher with PCs. Note the assumption that is involved in the personal computer curve is that it can perform more services than can the central computer at a given cost. To provide the same service at the terminals may require an incremental cost which would move the terminal cost line above the PC cost line (T_1T_2). For any given institution this implies an analysis of just how one would use the personal computer.

Having decided that personal computers could provide an effective way of satisfying need and at the same time off-loading some of the major crunch that was being experienced on the central computer, it was necessary to approach the problem of what personal computers to select. This investigation led us into some simple benchmarks of performance. Several units on campus had already acquired a TRS-80 MOD 1, MOD 2, Apple 2, IBM PC, Commodore Pet. Comparative performance statistics were available from the Association of Computer Users, who had tested the Apple 2, the TRS 80 MOD 2, Commodore, each with two drives. Our own internal tests were run simply as a quick check on the various available data. Figure 8 shows the result of these benchmarks.

The planning technique which was to be employed was to a large extent in place. The planning function took as its basic charge to provide adequate computer capability to meet the demands of the curriculum, research, and service as encountered in academic life. Emphasis was to be placed on departmental concerns both from the point of view of faculty and students. This is consistent with the University general planning objectives. An advisory committee which had been functioning served as a coordinating group as well as an advisory body to the various departments. On an individual basis, departments would take their recommendations and purchase certain pieces of equipment to service their needs. A listing of terminals on campus by location and by utilization was available. Listings of personal computers and microcomputers and where they were located were also available. Table 1 illustrates a summary of features that a user wanted. It also shows some of his evaluations and comments. This was supported by a detailed description of how the equipment would be used, what the primary factors were, what the secondary factors were, and what trade-offs could be accepted. The committee would further examine both hardware and software associated with the request as a function of performance, cost, and the mission of the unit.

Similar analyses were performed for the administrative computer. However, several significant differences must be acknowledged:

1. Security is a prime consideration.
2. Academic computers serve a large number of users, whereas administrative computers serve a relatively small number of users.
3. Academic computers are much more apt to be CPU utilizers whereas administrative computers are apt to be I/O oriented.

These characteristics would lead one to believe that administrative users would best be served by a central facility. Figure 9 shows the facility that is available at CMU. This facility provides the major part of the service and has increased its utility to the user through the introduction of database and retrieval systems. However, administrative users want the database available in a transparent mode for as many hours as they wish to use the database. This poses a problem for the computer center since time must be set aside for backup, update of the database, and maintenance. There are a significant number of applications in which administrative users resemble the academic user. A prime example is represented by administrators looking to enhance word processing capability with the computer at their side. The risks involved in this type of environment are well-known to people in administrative functions (e.g. problems in program maintenance, storing data). However, we have found that in several application areas the personal computer is justified. Investigations of these applications are continuing at the University.

At Central Michigan University we have committed to expanding via personal computers. The initial steps of the implementation plan have been added at each of the RJE public sites. Personal computers have also been placed in six of the dormitories with more to follow. Computer clubs have been started in the dormitories to ensure exchange of information and improved computer literacy. Classes for faculty have been provided at the introductory level. In the Business Education and Secretarial programs, typewriters are being replaced by personal computers with word processing packages. These can be used with other application packages. Furthermore, all faculty in computer intensive areas were provided with either a terminal or personal computer in their office. These steps are just the start of a more encompassing plan.

In summary, we have found that personal computers can greatly augment the central computer facility at the university. They can provide a degree of service which was not previously available. Finally, they provide an opportunity to save the cost of enhancing the central facility.

1974:	UNIVAC 1106 - 256K words 3 RJE SITES
1980:	UNIVAC 1100/60-786K words CYBER 172 - 131K words 3 RJE SITES 40 TERMINALS
1982:	UNIVAC 1100/60 CYBER 172 - 196K words 3 RJE SITES 125 TERMINALS MICROCOMPUTERS

FIGURE 1 - HISTORY

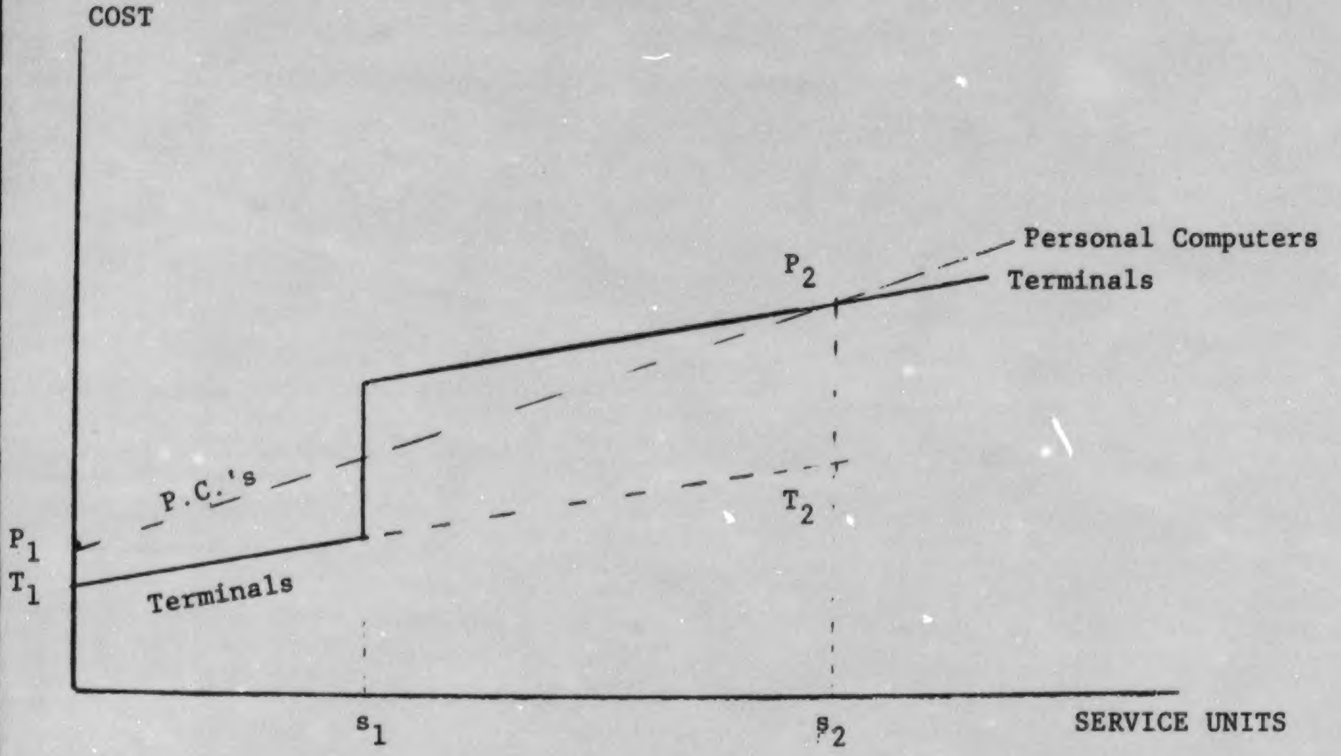
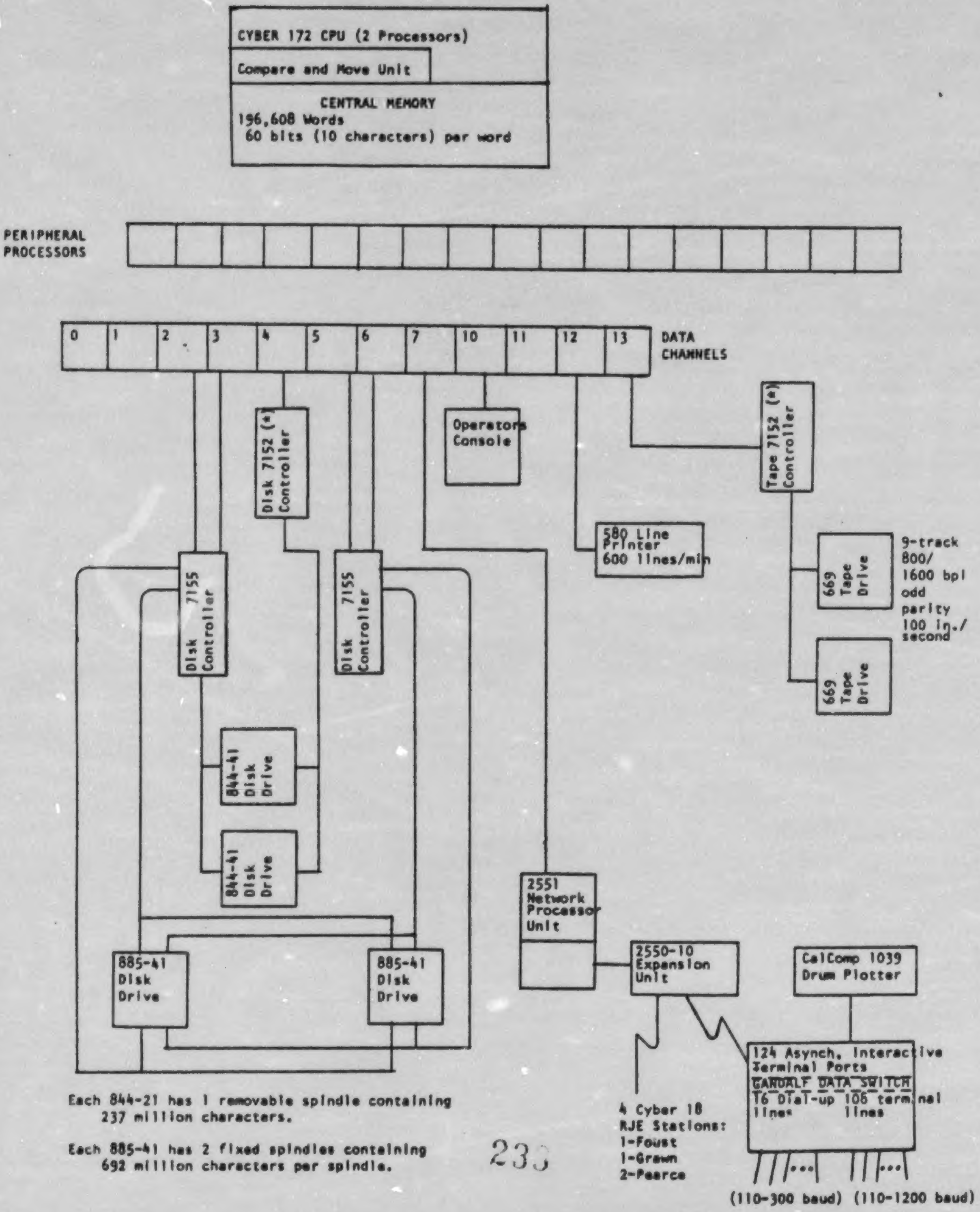


Figure 2 BREAKEVEN

CENTRAL MICHIGAN UNIVERSITY
ACADEMIC COMPUTER CONFIGURATION
8/1/82



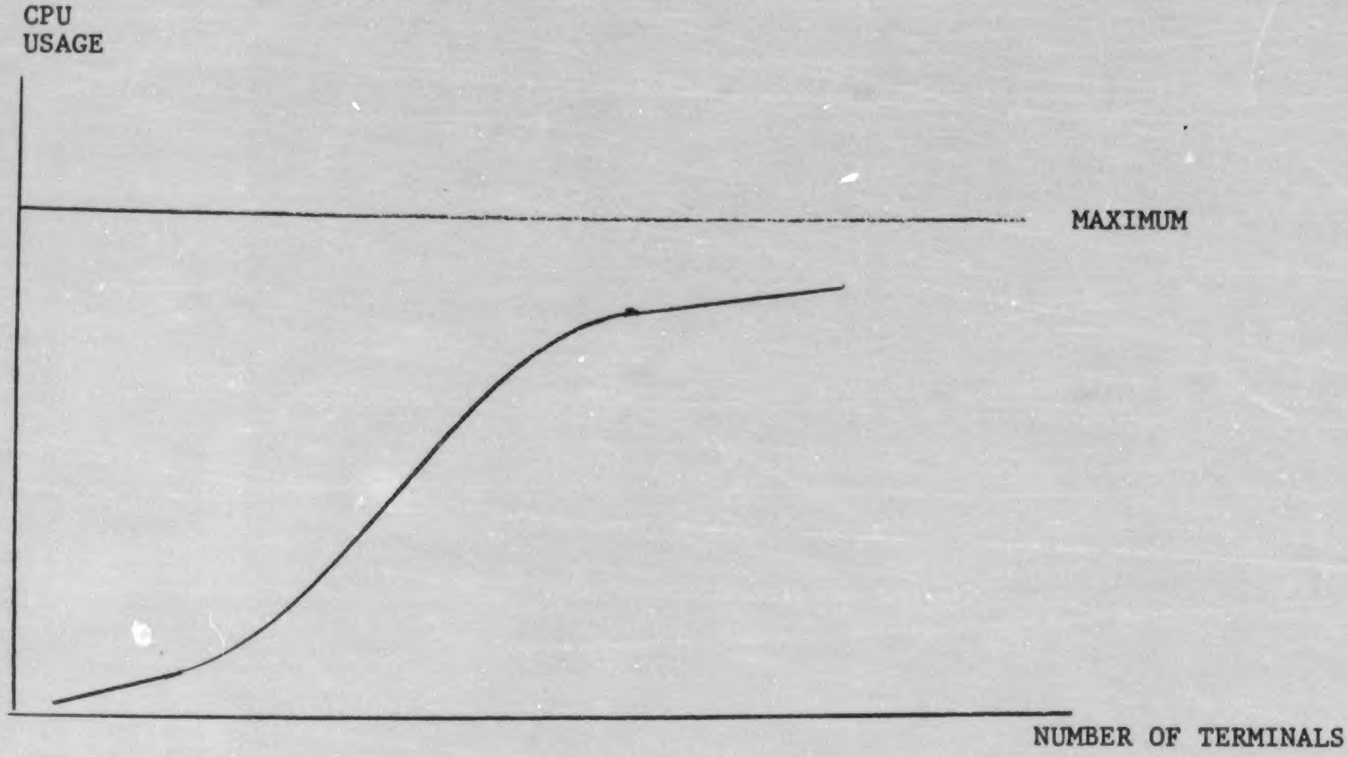
CYBER 172 CPU (2 Processors)
Compare and Move Unit
CENTRAL MEMORY
196,608 Words
60 bits (10 characters) per word
PERIPHERAL PROCESSORS
0
1
2
3
4
5
6
7
10
11
12
13
DATA CHANNELS
Disk 7152 (*) Controller
Operators Console
Tape 7152 (*) Controller
580 Line Printer 600 lines/min
Disk 7155 Controller
Disk 7155 Controller
669 Tape Drive
669 Tape Drive
9-track
800/
1600 bpi
odd
parity
100 in./
second
844-41 Disk Drive
844-41 Disk Drive
885-41 Disk Drive
885-41 Disk Drive
2551 Network Processor Unit
2550-10 Expansion Unit
CalComp 1039 Drum Plotter
124 Asynch, Interactive Terminal Ports
GANDALF DATA SWITCH
16 Dial-up lines
108 terminal lines
4 Cyber 18
RJE Stations:
1-Foust
1-Grawn
2-Pearce
(110-300 baud)
(110-1200 baud)

Each 844-21 has 1 removable spindle containing 237 million characters.

Each 885-41 has 2 fixed spindles containing 692 million characters per spindle.

233

FIGURE 3



TYPICAL USAGE PATTERN

FIGURE 4

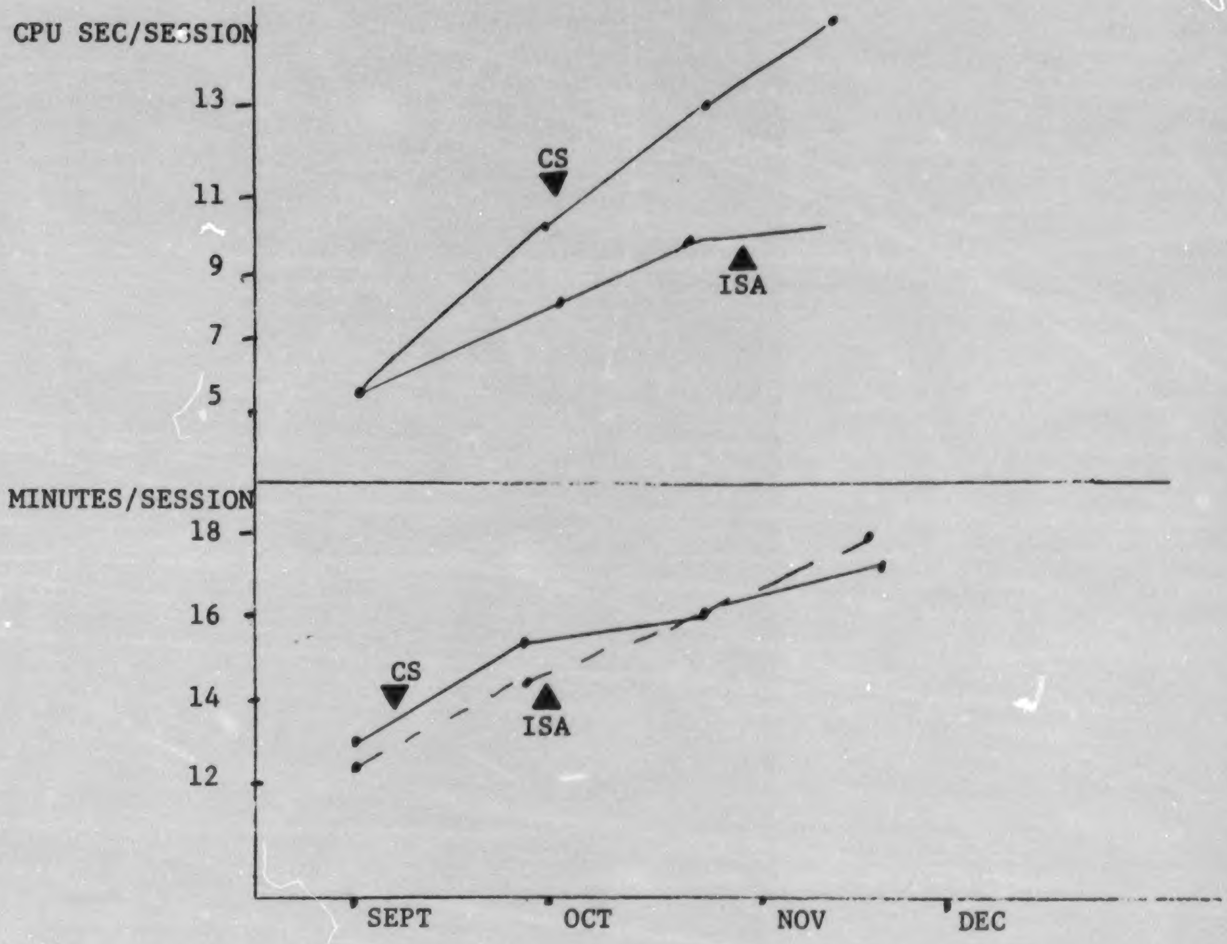


Figure 5 COMPUTER USE

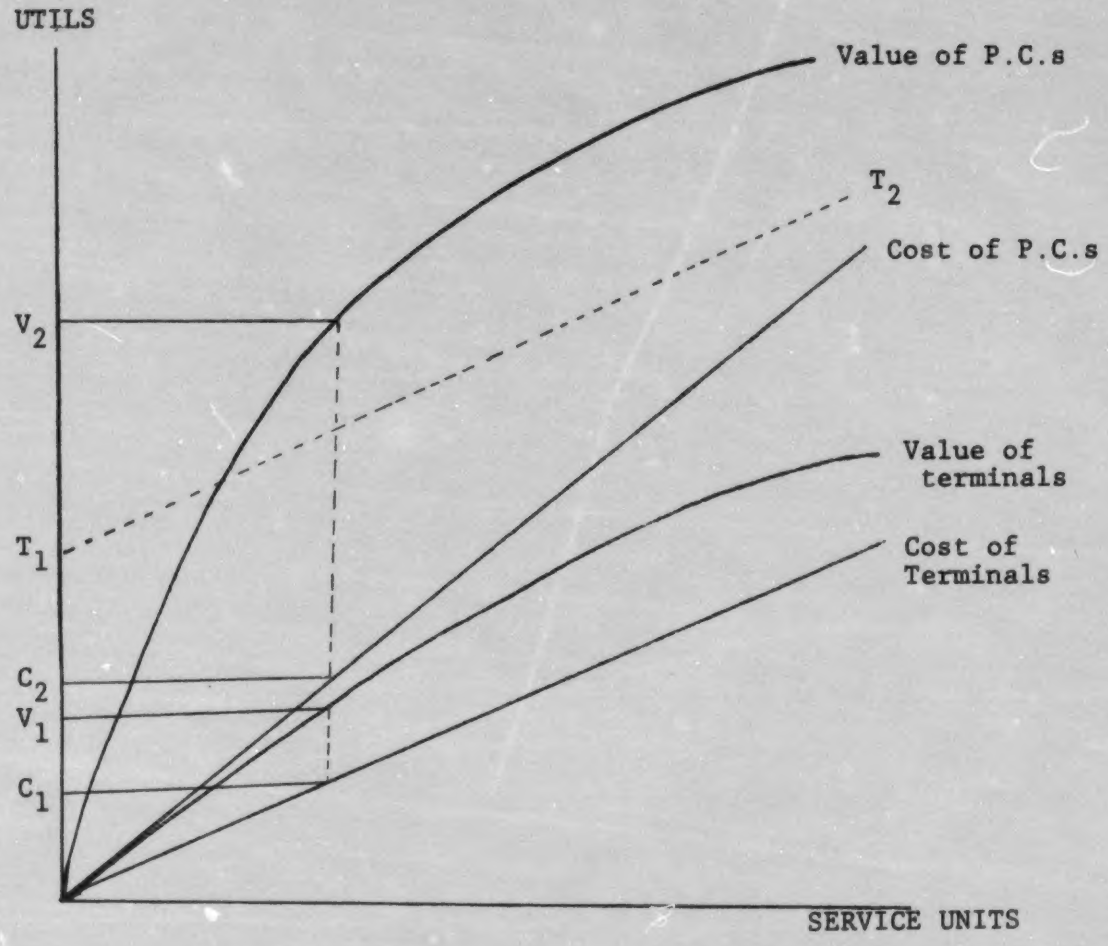
SERVICE FACTORS IMPORTANT
TO ACADEMIC USERS

1. AVAILABILITY
2. RESPONSE
3. ACCESS TO PERSONAL FILE
4. EASE OF PROGRAMMING
5. WORD PROCESSING
6. AVAILABLE PACKAGES
7. USER FRIENDLY

FIGURE 6

SYSTEM	MEMORY	DRIVES	OPERATING SYSTEM	MIN:SEC
Apple II	48K	2	CP/M	6:17.4
TRS 80 MODII	64K	2	TRSDOS	3:38.8
Commodore	32K	2	CPM	3:36.0

FIGURE 8



UTILITY ANALYSIS

FIGURE 7

ADMINISTRATIVE COMPUTER CONFIGURATION

UNIVAC 1100/60C

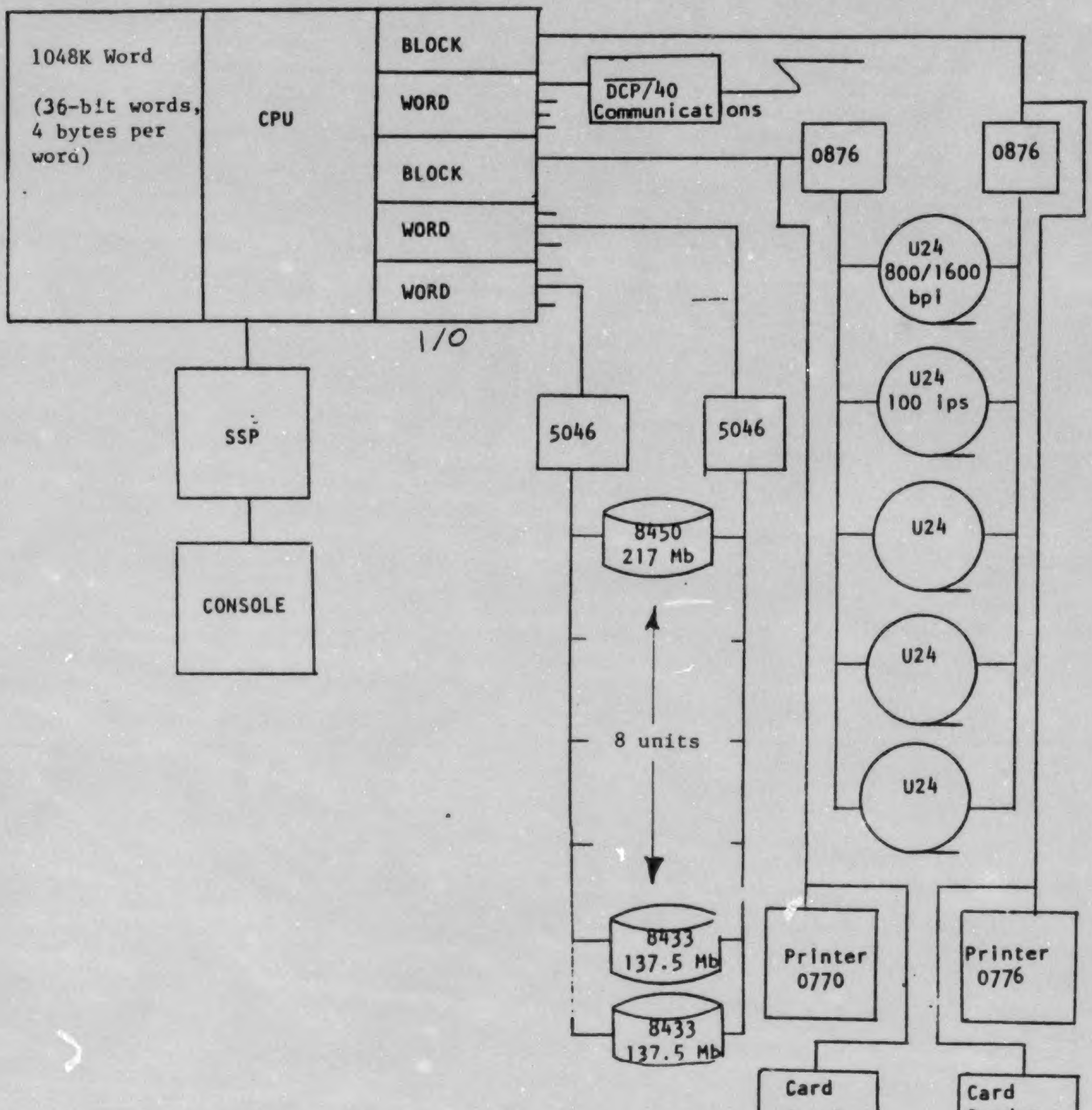

1048K Word
(36-bit words, 4 bytes per word)
CPU
BLOCK
WORD
BLOCK
WORD
WORD
I/O
DCP/40 Communications
SSP
CONSOLE
5046
5046
8450 217 Mb
8 units
8433 137.5 Mb
8433 137.5 Mb
0876
0876
U24 800/1600 bpi
U24 100 ips
U24
U24
U24
Printer 0770
Printer 0776
Card Punch 604
Card Reader 716

FIGURE 9

TABLE 1

Features	APPLE II +		IBM	
	Comments	Cost	Comments	Cost
Primary				
1. Basic unit with disc drive	(with 48K)	1350	(Configuration #2)	2316
2. Add on storage	(16K)	90	included	none
3. 2nd disc drive		394	included	none
4. Graphics	included (Resolution 192 x 280)	none	Adapter needed (Resolution 200 x 640)	240
5. Upper and lower case		49	included	none
6. Clock		104	included	none
7. 80 column display	(regular display 24 x 40)	299	included	none
8. 10 key numerical pad		150	included	none
9. Ease of use	good	none	good	none
10. B/W monitor		190		190
11. Technical manuals	Not obtainable	----	Very good	195
12. DOS Diskette	included	none		30
Secondary				
1. Color graphics	included	none	included in graphics above	none
2. Software availability	good	----	limited	----
Total Cost		2626		2971

MICROCOMPUTERS IN ADMINISTRATIVE DEPARTMENTS

Gerry Leclerc

McGill University

This presentation examined the installation of microcomputers in user departments, and the effect these small systems are having on the role of the university MIS department. Examples of microcomputer installations at McGill University were discussed. Topics covered included acquisition, typical applications, and problems related to the microcomputer phenomena.

Additional information can be obtained from Gerry Leclerc, University Management Systems, F. Cyril James Building, 845 Sherbrooke Street West, Montreal, PQ, Canada H3A 2T5.

MICRO PLUS MAINFRAME COMPUTERS:
New Levels of Responsiveness in Budgeting

Jon Lehr, Budget Analyst
Ian Strachan, User Liaison Specialist

SAN DIEGO COMMUNITY COLLEGE DISTRICT
SAN DIEGO, CALIFORNIA

I. INTRODUCTION

The San Diego Community College District (SDCCD) is the third largest community college district in the country with 6,000 faculty and staff, 100,000 students and an annual budget in excess of $100,000,000.

The SDCCD mainframe computer and Budget Preparation System (BPS) provide the detail budgets for five separate educational institutions and the various central administrative organizations. BPS does an excellent job of developing a budget. But, no matter how good a budget development system is, it cannot answer the two key financial questions: Where are we and where are we going?

II. MAINFRAME

In past years, the San Diego Community College District developed the budget on ledger pages. Although that manual system allowed maximum control it did not, without an exhausting effort, allow the District offices much opportunity to review the budget during the development process or the capability to analyze the budget broken into the various components of the District's account number structure.

The District, in recognizing this deficiency, purchased a budget development system to assist in the huge effort of data collection, modification, and budget review. The system was installed on the District's mainframe computer, a UNIVAC 90/80.

The mainframe budget development process starts in February of each year with the initialization process using the District's computerized Fund Accounting System. Using records from the prior and current fiscal years, four data elements are initialized for all active account numbers: (1) Prior year actuals are used to give historical perspective during the process (2) The adjusted budget for the current year gives the present plan (3) An estimation of the current year actual is intended to reveal the variance from the plan (4) The budget request amount is initialized with the current year's adjusted continuous budget for General Fund/ General Purpose accounts because many of them will remain unchanged. This results in a considerable savings in data collection. Both the current adjusted budget and the estimated actuals are updated periodically during the budget development process to reveal any changes which have taken place. Reports are sent to the major organizational units so that they may start the review and planning process.

Each of the District's four colleges, the Adult Education Division and the Administrative Offices have considerable autonomy in the movement of General Fund/General Purpose budget between cost centers and programs. They also have some latitude to move budget amounts between sub-accounts (object of expenditure). The District prohibits budget movement by the sites between major organizational unit and/or prime account. To assist in and for control of this portion of the process, the BPS provides the capability of entering resource allocation amounts at the major organization and prime account level and of reporting, both in a batch and on-line method, the status of budget requests versus the allocated control amount.

The development of allocation amounts starts with printing a report that indicates the initialized budget request amounts summarized by major cost center and prime accounts. These amounts are then reviewed and adjustments made based on District policies and projections of changes in student attendance. Allocation amounts are developed from this review process which include modelling on the micro for some of the prime accounts. The allocations are entered into the BPS on-line and the site readjustment activity can then take place.

A report is sent to each major organizational unit showing their allocations and the summarized budget request which was shown in the detailed report they received earlier. Each site reviews the reports in light of organizational objectives and plans. The desired changes can then be entered into the BPS by each site and reviewed for compliance with the allocation restrictions. There are several formula (controlled by student projections, such as supplies of instruction) sub-accounts within controlled prime accounts. Any changes in these sub-accounts requires action by the District Budget Office as the system will not allow update access to individual sites.

The realignment activity is scheduled to last approximately one month. After that period site update capability is stopped and any desired changes must be requested through the District's Budget Office. This is done because it is the Budget Office responsibility to balance the budget using the BPS and produce budget reports for Board approval. At this time, Business Services enters budget request amounts for grants, contracts and special purpose programs. As these are District developed and controlled funds they are entered after completion of the site realignment phase and may go through several iterations as revenue projections and grant status changes during the development process. Another main phase in the process is the projection of the salary and benefit budget.

The District developed an automated interface which provides information from the Personnel/Payroll/Position Control System to project the salary and benefit cost for 2,800 positions. For current contract positions salary budget is projected for current employees based on the current salary, annual increments to be received, and negotiated or estimated salary improvements. Hourly positions are initialized at prior year salary values and are then adjusted by each site. The total salary budget is based on projected student attendance. This amount is monitored by the Budget Office from reports they receive from the Student Information System. These projections are updated in the budget system periodically to reflect changes in employment, anticipated site needs and attendance projections.

Prior to July 1st of each year the District is required to publish a tentative budget which has been approved by the Board of Trustees. Basically, it is last year's continuous budget (excludes adjustments for the current year only) with adjustments in formula monies for the projected ADA (average daily attendance) changes, any approved projections of negotiated salary adjustments, any projected carry-over budget for grants and contracts on a different fiscal year, and budget for encumbrances of items not received.

After Board approval the tentative budget is entered into the Fund Accounting System for interim site control.

During July and August, adjustments are made to the Budget System as the Board approves budget changes. And, actual carry-overs are automatically entered. In early September, the Board approves the Final Budget which then becomes the Original Budget in the Fund Accounting System. Budget reports are produced reflecting this budget and the budget development process is concluded for that fiscal year.

There are two major reasons for utilizing the mainframe computer for the development of the budget. The first is the common use of the data base. The mainframe capability to provide many remote terminals update and inquiry access to the same items of information allows maximum flexibility without requiring a rigid reporting and notification system. The second reason is the capability to produce, in a timely manner, detailed reports for review and analysis. The District uses over 30 different reports which have over 18,000 entries. The Budget Preparation System provides the capability to report in a variety of summaries and combinations of the account number components.

Because of the multiple user access to the system, one area of possible concern is the Budget Preparation System security capability. Although the tentative and final budgets are public information, budget projections and the analysis performed during the development process are not. Also, the system assures that changes to the budget are being made by individuals who have responsibility for that portion of the budget.

To use the Budget System requires a user to sign-on and identify his department, himself and the appropriate passwords. Once logged on each transaction attempted is validated for the appropriate security clearance. Although the Budget Preparation System provides the capability to manipulate massive amounts of data, it does not provide for the development of the allocation control amounts nor does it completely answer the two questions raised in the introduction. Those are the functions which will be discussed next.

III. MICROCOMPUTER APPLICATIONS IN BUDGETING

A. Modelling

Aggregate data, groundrules and assumptions, a microcomputer, and electronic spreadsheet software can be extremely useful to financial staff as they attempt to answer the two key financial questions: Where are we and where are we going? What the microcomputer does and how it does it is entirely up to the user. The user's experience, training, and judgement determine the analysis that is performed. The microcomputer frees the user from the tedious detailed computational aspects of analysis. Of particular value is the ease with which changes can be made -- either data changes or changes in the structure of the analysis. SDCCD categorizes revenue and expenditures as being continuous (on-going or recurring) or limited (of a one-time nature). Using an electronic spreadsheet to develop a "General Fund Analysis" SDCCD aggregates revenue and appropriations under the limited and continuous categories. The program is designed to indicate whether the operational budget is in balance. Any proposed changes can be entered and the impact is seen immediately. The program also projects to the following year. The projection methodology can be specified just as the user desires. As the budget evolves, a continuous analysis and multi-year projection can almost be made without effort. Each time the model is updated, the user can immediately print a copy. This eliminates the time lag associated with typing. Management can be provided with the impact of the financial alternatives within minutes. This results in a significant improvement in the productivity of the financial staff.

B. Complex Formulas

SDCCD receives approximately $50 million annually from the State of California for general education purposes. The amount is determined by a complex formula using variables such as projected Average Daily Attendance (ADA), prior year District revenue, prior year statewide revenue per ADA, prior year District revenue per ADA, a statutory percentage inflation allowance, ADA growth or decline factors, and several others.

The State funding formula is provided in State law. Each community college district projects its own revenue based on local attendance estimates. At SDCCD the computations are included in the budget document. The computations are presented in a multi-year format. The presentation explains both the funding concepts and dollar amounts to administrators and the Board of Trustees.

Throughout the budget development process the variables are subject to change. Because the State budget is developed concurrently with the District budget, the funding concepts also are subject to change. With the microcomputer, SDCCD is able to rapidly recompute projected revenue as variables and concepts change. The immediate response to change complements the on-line Budget Preparation System on the mainframe. Fewer than five minutes are required to recompute a four page formula, print a letter quality copy of the formula computations (using the microcomputer), and update allocation amounts in the Budget Development file on the mainframe.

This capability to manipulate complex formulas is available with any of the electronic spreadsheet programs for microcomputers. The user determines the format and computations with relative ease, letter quality copies can be produced immediately. The real advantage to the organization is that staff spend less time on computation and more time planning and thinking.

C. Data Schedules

Schedules of data are simply lists with subtotals and totals. Typically, there are no complex concepts or sophisticated computations involved. Despite the simplicity of schedules, significant amounts of clerical and professional time are consumed in the preparation, changing and typing of schedules. While the advent of word processing has made it much easier to update schedules, the electronic spreadsheet programs for microcomputers can eliminate the word processing component of schedule production and updating.

In a manual environment the worst thing that can happen to a schedule is to add another line in the middle of a set of data. Cutting and pasting of worksheets, complete retyping and frustration result. If word processing is used, the updated worksheets return to the queue at the operator's station and probably receive a less than immediate priority assignment. SDCCD staff are preparing many schedules on the microcomputer. With the electronic spreadsheet program formats are limited only by the size of the paper used for the printed copy. It is extremely simple to insert or delete a row or column of data and the computer will automatically recompute totals and subtotals. The user, not a typist or word processing operator, produces a new copy of the schedule with a few strokes on the keyboard.

IV. CONCLUSION

Today's data processing environment can be divided into two distinct areas: Mainframes and Microcomputers. Each offers unique benefits accompanied by widely varying costs and limitations. By using both technologies, organizations have the opportunity to achieve new levels of responsiveness in budgeting.

Mainframes characteristics are:

- Ability to manipulate massive amounts of data.
- Ability to integrate all administrative systems (e.g. Budget Preparation System, Personnel/Payroll System, Fund Accounting System Student Information System).
- Ability to provide decentralized, on-line access to data while maintaining centralized control.
- Ability to mass change data.
- Ability to provide comprehensive, recurring reports.
- High hardware and software costs.
- Requirement for professional staff to maintain and change software.
- Time delays when software changes are required.

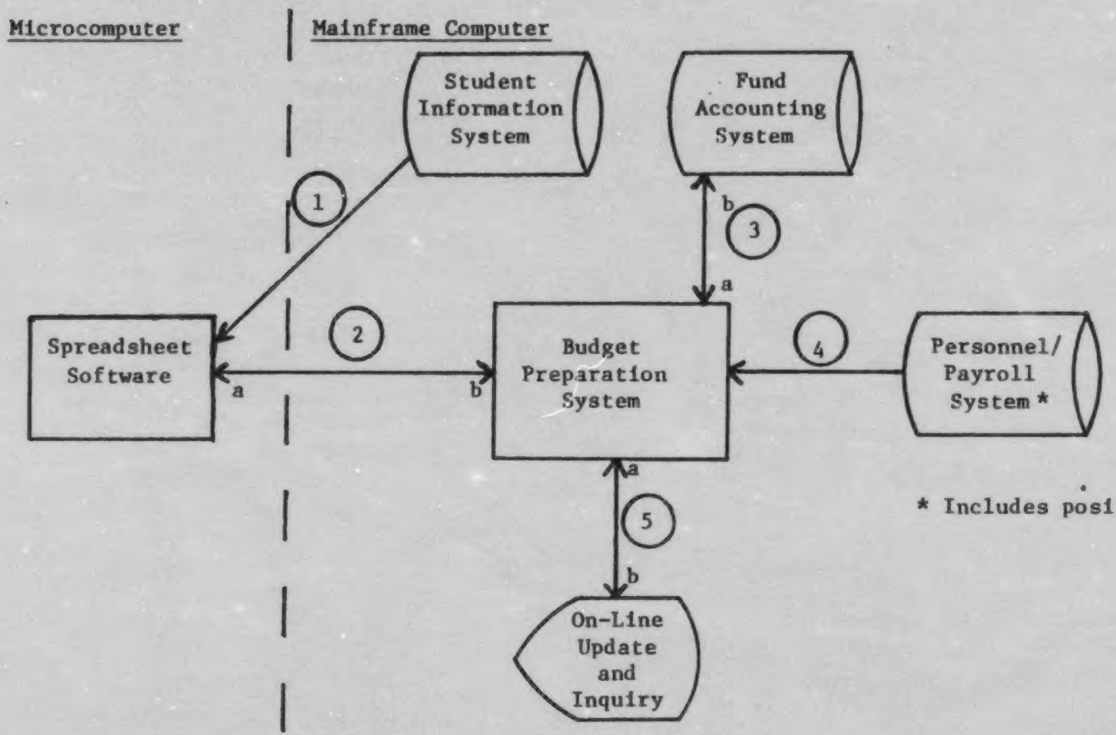
Microcomputer characteristics are:

- Low cost, hardware and user-friendly software.
- User-developed programs that can be changed by relatively unsophisticated users.
- Total user control.
- Flexible applications.
- Limitations in processing and memory capabilities.
- Interface with mainframe requires professional programming support.

The task facing management is to find the optimal allocation of functions between the two tools. SDCCD has found that the microcomputer is ideal for addressing changes brought about by external factors, e.g., changes in finance law and changes in assumptions regarding inflation, as well as assessing the impact of internal policy changes. Any situation that involves a "what if" question is probably best addressed with the microcomputer. Whenever possible avoid manipulating the entire data base and avoid changing mainframe programs. The answer is simple -- use a microcomputer.

SDCCD believes that using the mainframe for detailed data manipulation, recurring reports, interactive budget development, audit trails, traditional fiduciary accounting and widespread access to data best utilizes its strengths.

BUDGET DEVELOPMENT DATA INTERFACES


Microcomputer
Mainframe Computer
Student Information System
Fund Accounting System
1
b
3
a
Spreadsheet Software
2
a
b
Budget Preparation System
4
Personnel/ Payroll System *
a
5
b
On-Line Update and Inquiry

* Includes position control capabilities.

1. Provides Average Daily Attendance Information for projections.

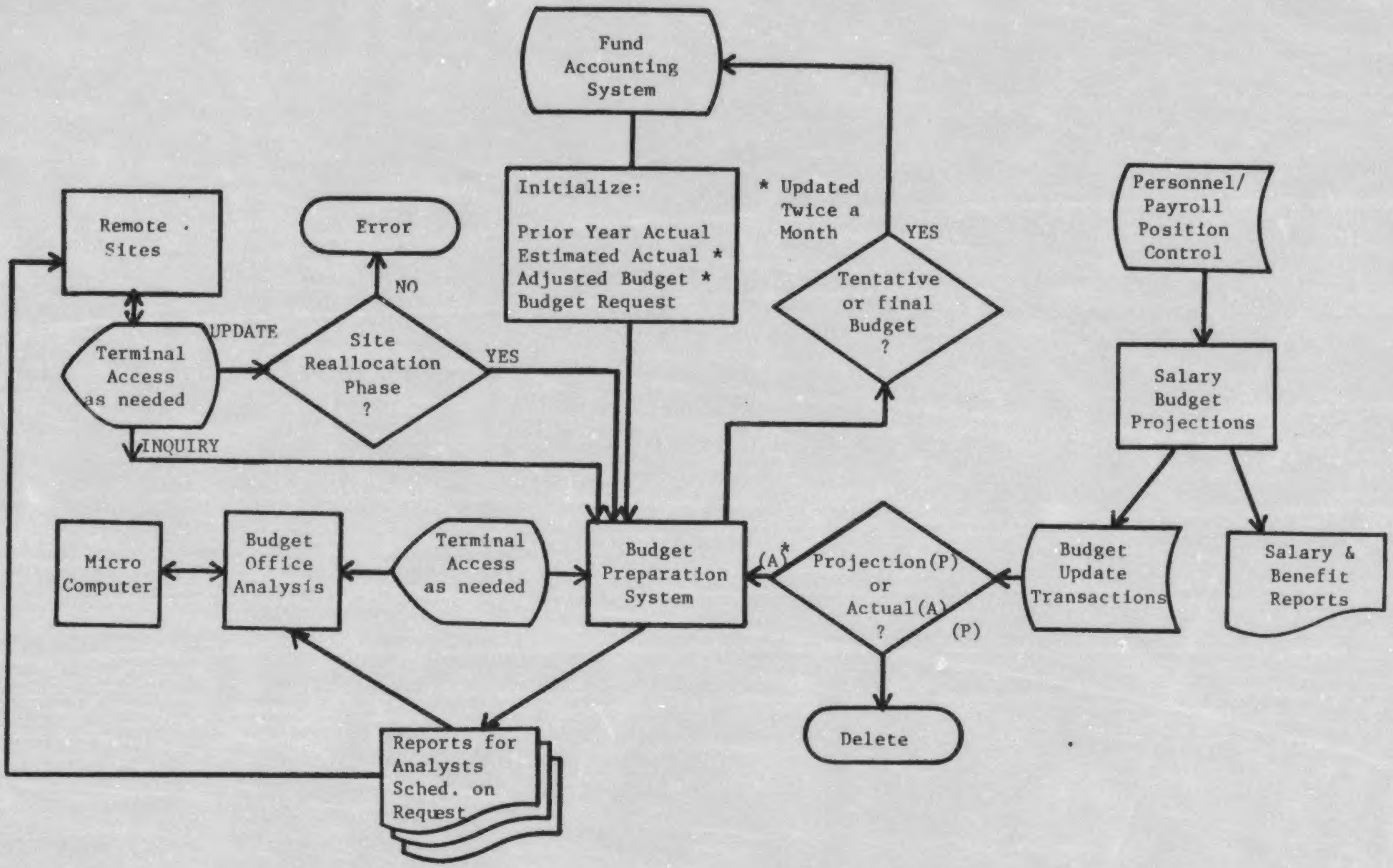
2. a. Provides Summary Accounting Information for projections.
   b. Provides Budget Allocation Amounts for formula expenditures.

3. a. Loads values for Prior Year Actual Expenditures; Current Year Adjusted Budget; Current Year Estimated Actuals; Initialization of Budget Request.
   b. Loads Board Approved Budget into the Fund Accounting System.

4. Loads budget for salaries and benefits based on projected salary leads.

5. a. Allows on-line input of all allocation and budget request amounts.
   b. Provides Districtwide review of budget information and status.

BUDGET DEVELOPMENT FUNCTIONAL FLOW


Fund Accounting System
Initialize:
Prior Year Actual
Estimated Actual *
Adjusted Budget *
Budget Request
* Updated Twice a Month
YES
Tentative or final Budget ?
Personnel/ Payroll Position Control
Remote Sites
Error
NO
UPDATE
Terminal Access as needed
Site Reallocation Phase ?
YES
INQUIRY
Salary Budget Projections
Micro Computer
Budget Office Analysis
Terminal Access as needed
Budget Preparation System
(A)*
Projection(P) or Actual(A) ?
(P)
Budget Update Transactions
Salary & Benefit Reports
Reports for Analysts Sched. on Request
Delete

Theory 'Z' Management and Computer Literacy:
Facilitating the Evolution of a Computer Utility

Sally Campbell

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A computer utility can best be defined by its characteristics: a service available to all, and a repository of information with minimum direct computer center involvement and maximum direct user involvement. The service and central repository characteristics are primarily provided by new applications of technology.

The shift in computer center and user office personnel involvement, however, transcends technology and is a management issue linked closely with computer literacy. This paper will explore how Pepperdine University applies Theory 'Z' Management to achieve administrative computer literacy, and then nurtures this user literacy and involvement to evolve into a computer utility.

Introduction

Over the past twenty years, administrative computer services has evolved from a record keeping or number crunching activity to an information service. Ultimately we see it evolving into a computer utility through the use of decision support systems and advances in management techniques. A computer utility can best be defined by its characteristics which are as follows.

- It is a service available to all.
- It is a repository of information.
- It requires a minimum level of computer services direct involvement.
- Correspondingly, it requires a maximum level of user responsibility and computer literacy.

It may be easier to conceptualize a computer utility by drawing analogies with familiar utilities. For example, such services as electricity, telephones, and libraries are repositories for power, communication tools, and information, respectively. A computer utility differs from these because the data or information of this utility must first be put into it before it can be gleaned from it. Thus, more information storage and retrieval savvy is required of administrative users in order to evolve into a computer utility.

Administrative Computer Literacy

While a comprehensive definition of literacy is provided by the Association for Computer Machinery, it may be more convenient to measure computer literacy for administrative users by grouping literacy items into four distinct categories. These are:

1. Control and program a computer.
2. Use and understand preprogrammed software.
3. Understand the impact of computers.
4. Make use of ideas contained in applications for communication and problem solving.

A practical operative definition can parallel these four categories. At Pepperdine University we see that for category one, our users demonstrate their literacy level by using retrieval packages. For level two. they must be able to use and understand application systems. Understanding the impact on other departments, employees and students of the university illustrates the achievement of literacy level three. Finally, literacy level four can be demonstrated by the use of decision support components, such as electronic mailing, modeling or graphics.

If computer literacy can be visualized as a continuum of achievement, literacy levels can be characterized over time by users leaving a very dependent state and becoming very independent in their use of computer services. Figure 1 illustrates particular milestones in the systems development cycle which indicates stages along that literacy continuum. The stages of the computer literacy operative definition are positioned along this continuum as follows: Once the users have requested assistance for computer services, and before they are intimately involved in the design of their system, they are trained in the control and use of an appropriate retrieval package for their administrative area. While they are involved in the design of their system, they begin to learn the impact that system may have on other user departments, students or employees. Shortly before that new administrative system is put into a production state, the user department personnel learn how to use their preprogrammed application software. As is typical with any new system, once the users have had it for a period of time, they begin to think of ways their system could be improved. Because our users as a group are responsible for approving all system enhancements and for prioritizing those projects, the user departments achieve a great deal of understanding of the impact that those enhancements may have on the rest of the university. Finally, as the users become more and more literate in the use of their system, they begin to request the use of decision support tools such as modeling and graphics packages. This represents the most independent stage in their literacy progress, since at that point they can use the ideas contained in those applications for communication and problem solving.

It is our belief that there are three key success factors for achieving administrative computer literacy. The first of these is to obtain top management support. That support should be characterized by the commitment of resources including time, people, and money. Without that top level support, neither will the appropriate training and involvement occur nor will those who are skeptical or disinterested be appropriately encouraged to participate in the evolutionary process. The second key success factor is education. This education must be relevant to each organizational level so that the knowledge will be retained and so that participants will become interested in the educational process. This training is a natural outgrowth of the third key success factor, which is involvement. At Pepperdine University the involvement of our users is achieved through the application of many of William Ouchi's Theory Z Management components.

Theory Z Management

After studying Japanese management Ouchi discovered that a number of their management characteristics or components were shared by some very successful American corporations. He called this list of components a Japanese template. A majority of those template items which are applied at Pepperdine University are as follows:

- Long term employment
- Slow evaluation of progress
- Non-specialized career paths
- Wholistic concern
- Consensual decision-making
- Informal, impli[illegible]ontrol

The resultant premise is that the organization is more important that the individual. The application of Theory Z Management at Pepperdine University is not straightforward. Rather it is manifested through four discrete but related items. The following paragraphs will provide a more comprehensive explanation of each of these four items. Figure 2 summarizes how each of the four items represent application of theory Z.

The first and most straightforward is long term employment. Pepperdine University encourages the retention of their employees through involvement and non-specialized career paths. Also, it is not infrequent that employees who have chosen to leave Pepperdine return to their previous positions once they have discovered that "that the grass is not greener on the other side."

The second item is the committees which have been established to approve and monitor the activities of computer services. Briefly, these comittees are: The Systems and Planning Committees (S & P), The Data Administration Group (DAG), The Inter-Office Communication Committee (ICC) and various task forces. The S & P Committee meets bi-weekly and is composed of vice-presidents. They review and approve all mainframe hardware and software acquisitions and all staffing level changes within computer services. They are also responsible for approving and prioritizing all new development projects. The second committee, DAG, meets bi-weekly and consists of mid- and upper-level managers who are responsible for the approval and prioritization of all enhancement projects. Soon, this committee will be responsible for the acquisition of all hardware and software relating to microcomputers. The third committee, the Inter-Office Communications Committee consists of first-line managers and users of the system from all administrative departments affected by computer services. This committee meets weekly and resolves such issues as the use and ownership of data elements within the data bases and inter-office training requirements. Further, a subcommittee of IC is responsible for establishing the production schedule approximately two months in advance.

Various task forces are established not only to monitor the progress of development projects, but also to collectively perform the system analysis function for that project. Usually, these committees are composed of two individuals from computer services and four to eight members of various user office personnel. A collective responsibility for each of the new development projects is encouraged. Further, these committees are typically chaired by an inexperienced user office representative who receives on-the-job project development training.

The third item typifying Theory Z Management application at Pepperdine University is the Decision Support Coordinators (or DSC's). These individuals work within computer services as representatives of the various user departments and as representatives of the best interest of the University. The DSC's typically do not have a background in data processing but do have experience in a variety of user departments. They function as translators, trainers, planners and consultants. Their consultation transcends data processing in that they also function as facilitators of change. Their long employment record with Pepperdine (for which the DSC's currently average approximately five years) ensures that computer services has a "corporate memory" with respect to data processing at Pepperdine. As watchdogs of the good of the University, the DSC's facilitate an wholistic concern throughout the entire University. Although they report to the Manager of Systems and Programming they participate actively in decision-making at many levels within computer services. Finally, they help to facilitate informal and implicit control by encouraging users to fulfill their obligations in the systems development process.

The fourth item typifying Theory Z Management at Pepperdine is the application of linking-pin communication, which provides for information flow not dependent upon our organizational structure. This communication serves the dual purpose of encouraging wholistic concern through consensual decision-making, and facilitating slow evaluation and informal, implicit control. Linking-pin communication is implemented by having cross-membership among various committees overseeing the activities of computer services. Further, the freedom of communication ensures that no individual in the organizational hierarchy can have a detrimental effect on the activities with respect to the good of the University. Yet another form of communication is our Service Appraisal Report (SAR) administered by the University Data Administrator (UDA), who reports directly to the Vice-President of Systems and Planning. The UDA solicits from the users candid, written comments each month on some eight areas relevant to the functioning of administrative computer services. Careful scrutiny of the SAR report can also alert computer services to the need for more education or more involvement of the administrative systems users.

Systems Development Process

With Theory Z Management facilitating the increase in administrative computer literacy, and that literacy facilitating the evolution of the computer utility, we might next question what effect this evolution will have on the system development process. The typical computing environment requires a great deal of computer services involvement to develop new systems. A variety of steps are necessary, partly to facilitate the education and involvement of the users necessary to achieve greater computer literacy. Figure 3 represents the current involvement of computer services and client office individuals during the life cycle of an administrative system. The various milestones are identified along a time continuum.

The NAR (Needs Analysis Report) represents that point in time when preliminary systems analysis has been accomplished by the appointed task force. As you can see, once the NAR has been written, client involvement tapers off and a great deal of computer center involvement is required to develop the particular system. Before that system is moved from a development stage to a production stage, the client office becomes more involved during the integration test process. This increased involvement is represented by the shaded area between the test and implementation phases. During this time the users learn their new system and have the opportunity to make modifications before those modifications are considered enhancements (which must be approved and priortized along with all other requests). Because of that increased involvement and because of the ability to modify that system, the users experience a corresponding increase in satisfaction with their system.

Once the system has been implemented, the client involvement remains reasonably high. As time progresses, the users usually will request that enhancements be made. During the enhancement definition periods, users must be directly involved. The computer center's involvement at this stage is provided primarily by the Decision Support Coordinators. However, once the enhancement has been approved, programmers are assigned to that project as their resources become available.

This cycle continues as more and more enhancements are made to the existing systems through computer services efforts. You will note that the time period between enhancement definition and enhancement test is lengthy. The delays experienced while waiting for adequate resources to become available in computer services often are the result of the "big bulge" of computer services involvement in other concurrent projects, similar to that shown in the first third of this figure.

Some of the anticipated advantages of becoming a computer utility are the elimination of the resource bulge required at the beginning of systems development, as well as a reduction in the time necessary to implement enhancements to an existing system. With the user offices assuming responsibility for the development of their new systems and enhancements to those systems, client office involvement will remain high and computer center involvement can remain relatively low as is shown in Figure 4. It is anticipated that through the use of user development tools, heavy technical and detailed involvement of computer services will no longer be necessary. By the time that we have achieved a computer utility, the user office will be computer literate and will no longer require the long and involved process of education. Rather, through consultation with the DSC's, and through a process of trial and error with their own development tools, the period of time between need identification and implementation of a new system and of enhancements will be reduced significantly.

Evolution of a Computer Utility

Implicit in the evolution of the computer utility are significant changes within computer services. Because there is such a reduction in computer services resource requirements, there will be a corresponding reduction in the power wielded by computer services. Thus, we must be able to gracefully relinquish that power and pass it over to the administrative clients.

This evolution also implies a change in the roles and functions of conputer services personnel. Consistent with our five year plan, we anticipate the elimination of the data entry function. On-line systems and user friendly retrieval packages will eliminate the need for the data entry function to resude in computer services. The role of the Decision Support Coordinators is also anticipated to evolve from problem solving to consulting.

We anticipate an increased need for competent and conversant DSC's which may be fulfilled by developing no longer needed programmer/analysts into DSC's.

Computer services must maintain this posture of anticipation. With less systems design and development effort required, computer services will need to provide more consultation services. To be effective consultants, we must continue to anticipate what the users will need next, both in technology and applications. Further, we must begin to anticipate what the users should be thinking of next, so that we can provide them with adequate guidance and education in a timely fashion.

With our dedication to evolve into a computer utility, there are certain actions that we should take to advance that evolution. First, we must remember to involve our clients in every aspect of the systems development, maintenance, and enhancement cycle. Implicit in this involvement is teaching our clients by example. Often it is wise to let them flounder and then ask for guidance, because they will be more receptive to what we have to say. Second, we must listen carefully to the jargon that is used by the clients as they try to increase their understanding of computers, and guide them if they misuse that jargon. Third, we must help them keep the task forces and committees on track and meeting regularly. We can also advance the evolution by tapping administrative systems expertise within various user offices. We have found it very beneficial to involve seasoned clients who can provide guidance which is both relevant and very understandable.

As with any evolutionary process, we must be able to monitor our progress. This can be done in a variety of areas and in a variety of ways. First and foremost is that an Information Resources Management division must be established. Without a true IRM division it may be very difficult to integrate all the technology that is necessary to evolve into a computer utility. Second, we must establish base on-line systems with supportive policies and procedures. These on-line systems are necessary to move data input responsibility to the source of that information.

Next, feedback mechanisms must be maintained for accountability and identification of educational needs. Our Service Appraisal Report quickly and easily fills this function. Also, open communication between the users and computer services, and between various levels within computer services, provides a maintenance mechanism to ensure that this evolution continues to progress. Additionally, the committees, DSC's and SAR's can serve as progress maintenance mechanisms.

Finally, we must be able to monitor the achievements of administrative computer literacy. This literacy must be broad-based and applicable to all of the various levels of management within the University. As employees move in and out of these different levels, their literacy should be brought in line with literacy achieved by the other members of those committees.

Getting Started

In summary, there are six items which we feel are important for you to get started in your evolution towards computer utility.

1. Acquire top management support and involvement. This is absolutely necessary, for without that top management support neither will there be a commitment for administrative users to go through the educational process necessary to achieve an adequate level of computer literacy, nor will there be the support necessary to establish an IRM division.
2. Establish key positions. We have found the DSC and UDA positions to be key in our evolution towards the computer utility.
3. Establish monitoring mechanisms. Our SAR is an excellent mechanism, not only to ascertain the relative satisfaction of the users with their systems and with the services provided by the computer center, but also to indicate a particular problem area or an area where additional education or involvement is required. Another monitoring mechanism is the network of standing committees which meet on a regular basis.
4. Establish effective committees. A Certain amount of persistence is required to establish effective committees and to ensure that these committees assume the responsibility necessary to achieve that evolution. We believe that there are three main components in

establishing these committees to ensure success. They are as follows:

a. The chairman selected must be high enough in the organization to be respected, and inexperienced enough to gain a very personal understanding of the problems inherent in the systems life cycle.

b. The size and complement of members are integral to the success of the committee. As few people as possible from computer services should be members so that the administrative users do not feel threatened. It is important to draw from many user offices so that an increased understanding of the impact of computer systems on other departments can be readily achieved. This sharing of information not only increases computer literacy, but also ensures that there will not be a conflict between the computer systems which will ultimately be integrated.

c. The committee must be given a charge. That charge will include the committee's purpose so that the members can establish appropriate goals and objectives. The committee must be given a time frame in which to achieve those goals and objectives. And, the committee should be given an expected end product, whether it is a NAR, policies and procedures, a proposal, or a request for information. This baseline structure provides the committee with direction and an incentive to meet regularly.

5. Maintain momentum. There is nothing more discouraging to a group of people than to have worked very hard on a project for a number of months and achieved its end product, only to have that particular system or that development project put on the back burner and ignored for a year. This loss of momentum results in a loss of enthusiasm which will make it very difficult for that same committee to be effective once it has reconvened.
6. Guide, listen, and learn. Guide your users by providing background assistance. When they ask, teach them how to lead a group and what to do next. Listen to your users and provide encouragement, enthusiasm and humor when it's needed to keep that momentum going. Listen to your users for the way that they use technical jargon and ensure that they, in fact, understand the implications of the words they're using. Become a catalyst for inter-office cohesion and learn from the experience yourself.

We have seen that Theory Z Management provides the framework for involvement of the entire University community in computer center activities. This involvement leads to a higher level of administrative computer literacy, and that literacy helps to facilitate the evolution towards computer utility. As with any infant, in order to achieve a computer utility you must remember to be empathetic, be flexible, be supportive but not doting, be nurturing, be compassionate but not capitulating, and be political. Try incorporating some Theory Z techniques in your organization. Then, sow the seeds of computer literacy and let the computer utility idea blossom and grow. Finally, have conviction that it can be done and that you can do it.

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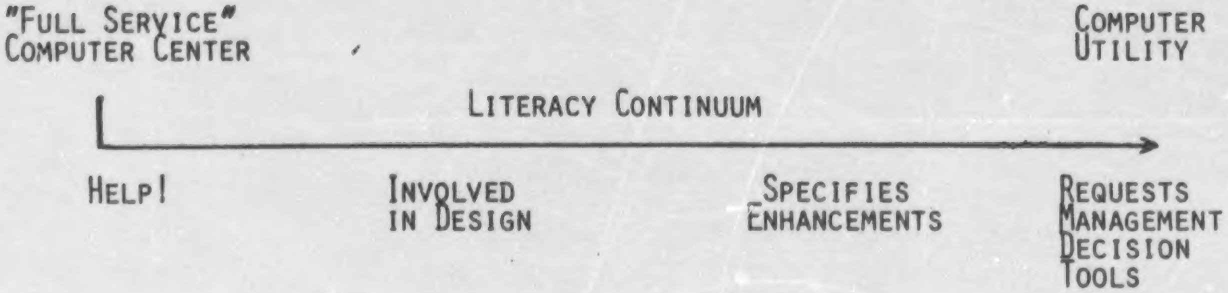
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COMPUTER
UTILITY
LITERACY CONTINUUM
HELP!
INVOLVED
IN DESIGN
SPECIFIES
ENHANCEMENTS
REQUESTS
MANAGEMENT
DECISION
TOOLS

Figure 1. User Independence Along the Computer Literacy Continuum.

	Long term employment	Committee Structure	DSC (Facilitator)	Linking-pin communication
Long term employment	X		X	
Slow evaluation		X		X
Non-specialized career paths	X		X	
Wholistic concern	X	X	X	X
Consensual Decision Making		X	X	X
Collective Responsibility		X	X	
Informal, Implicit Control		X	X	X

Figure 2. Application of Theory 'Z' Management Components at Pepperdine University.

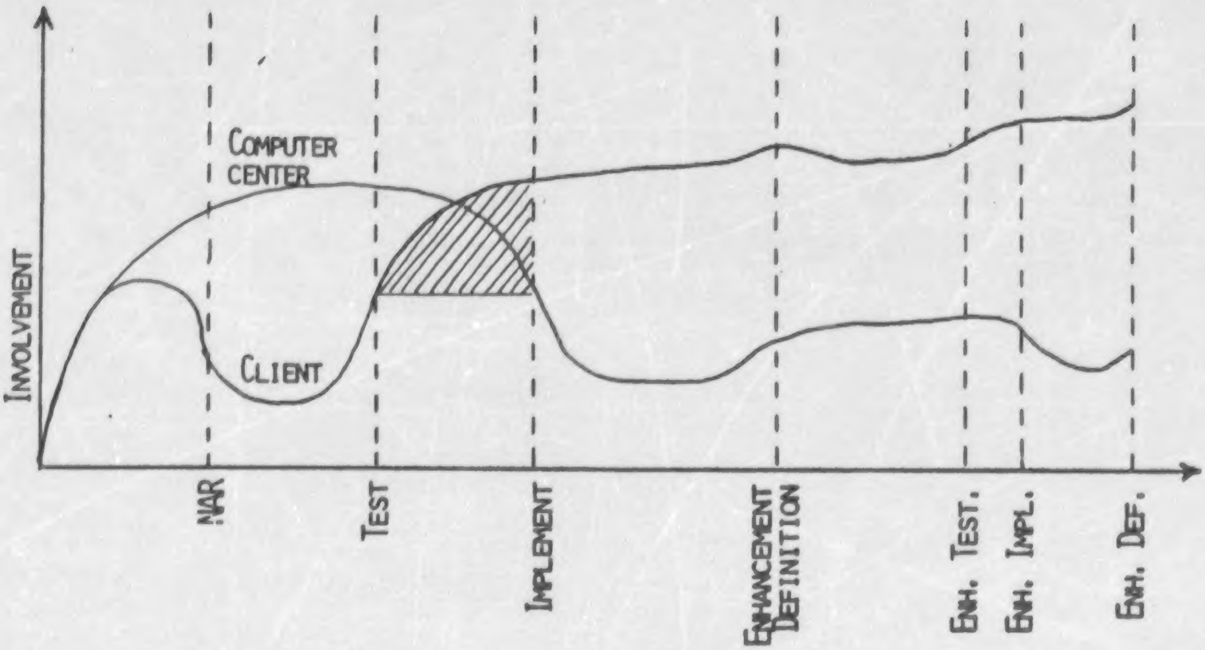

Figure 3. Involvement Levels and Life Cycle Milestones in a Typical Computer Center Environment.

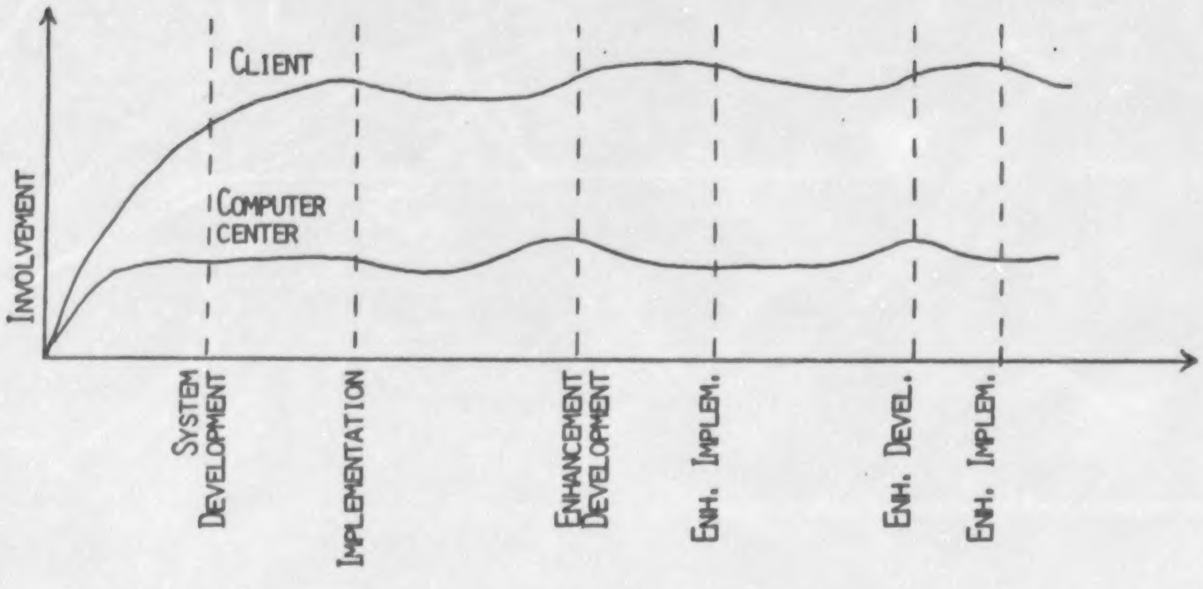

Figure 4. Involvement and Milestones Anticipated in a Computer Utility Environment.

PRODUCTIVITY AND THE INEXPERIENCED PROGRAMMER

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Ball State University, like many colleges and universities, has difficulty attracting and retaining experienced computer professionals. Because of this, we are often faced with a large body of inexperienced programmers. With the tremendous demands for application development and enhancement that we have, maximum productivity from this body of inexperienced programmers is critical to our successful operation.

Because of this, we have put into place several tools and techniques which seem to work well in increasing the productivity of our programmers. These efforts were made primarily in conjunction with our current project of redesigning and reprogramming our student information system to a database environment but have been applied with equal success to other efforts.

PRODUCTIVITY AND THE INEXPERIENCED PROGRAMMER

This presentation on productivity and the inexperienced programmer will offer two distinct views of this growing population in data processing within higher education. The first view will be that of management. The second will be that of the first-line supervisor. Though these two distinct views are alike in many ways, particularly in improving productivity, they also differ in their perspective and focus. The management view is one of concern while the supervisors view is one of implementing the techniques to improve the situation.

Universities like many other organizations continue to suffer from a critical shortage of experienced data processing professionals. Because of some unique aspects in our environment - perhaps the most noteable being low entry-level salaries - we have had to face the very pragmatic situation of hiring inexperienced programmers or learning to live with multiple vacancies.

Over the past several years productivity in data processing has been written about and examined from almost every possible angle, but in hiring the inexperienced programmer the very real gap in productivity cannot be easily overcome by software tools or development techniques. This paper will, however, address some techniques that we have found successful in attacking the skill gap that can only be bridged in its entirety through experience.

From management's perspective, the most critical element in attempting to raise the productivity level of inexperienced programmers is to reduce, as quickly as possible, the lost time required to effectively train them. The criticalness of this does not center so much around the lost time for the new employee because this is always a factor in any new employee becoming acclimated to a new job. However, it is very critical in terms of the lost time of the employee assigned to train the new staff member, because that person is normally very experienced and frequently is one of the most productive persons on the staff. Though we have made use of a "buddy" system so that each new staff member has one person to address his questions to, it can even be more time-consuming for the "buddy" than if the new employee were given free rein to ask questions of anyone. Another factor that can increase the lost-time for the inexperienced programmer is the fact that for the majority of them it is either their first full-time job or it is a mid-career job change. Either way they are not only inexperienced in terms of data processing techniques, but they are also quite likely to be inexperienced in basic employee skills such as avoiding tardiness, etc. The final factor that impacts lost time for these new employees is that without exception, none of them that we have hired have had any experience in higher education. Thus they must also become accli-mated to the academic environment. They are, however, not often involved in the mainstream of campus activities such as teaching and research.

The second item of concern from the management view is to express some dissatisfaction in the content of the formal education that students are now receiving. Though most four-year computer science programs offer a good to excellent conceptual base of knowledge, it appears that they are not being very effective in terms of preparing the student for the "real world". Things like the importance of documentation, testing of programs, the necessity of preparing code that can be undersood by others, preparing a program for production turnover, etc. may not be very important in the classroom but is extremely critical in the development of production systems. In some ways, the graduates we have hired from two-year programs have better vocational skills, but their knowledge of concepts and the ability to synthesize information is often not as good as the person with a four-year degree.

A third concern of management in the use of inexperienced programmers is the overall skill level which most of them possess. Though this relates to the above point it is important to focus on the inexperienced person's ability to synthesize all of the knowledge obtained in a formal training mode and adapt it to form useful on-the-job skills. To specifically address this concern we have developed a skills inventory collection instrument which we are in the process of implementing. Hopefully this will not only be meaningful in identifying training needs but also for assistance in the development of meaningful and realistic career path plans.

The final concern from management's view is finding a means to communicate with the user community the lower productivity level of the inexperienced programmer. User demands have not diminished just because we are unable to hire experienced staff. Not that the users are unaware of our plight, it's just that they are faced with many of the same problems we face in terms of inexperience and lack of knowledge about higher education. However, their problem is translated into requirements for improved productivity which often equates to the development of additional automated systems.

This concludes the brief discussion of management concerns related to use of inexperienced programmers. In a more practical sense the following discussion will focus on the view of the first-line supervisor who must develop and implement techniques to insure that there is a real increase in productivity of the inexperienced. Fortunately, we have found that the techniques we have developed have been helpful not only to the inexperienced but also to our more experienced staff.

In order to enhance the productivity of these inexperienced programmers, we put into place, among other things, the following tools and techniques:

1. Skeletal programs for CICS and IMS batch programs, skeletal CICS maps, skeletal program specifications, and skeletal catalogued procedure specifications.
2. Copy features, for both data and procedure divisions to assist in IMS calls and other difficult routines.
3. Subroutines to provide commonly used routines.
4. Programming guides and standards.
5. Various VM/370 components used during program development and testing.
6. A data dictionary to assist in the documentation effort and to aid in field usage review, etc.
7. Peer review of work products.

8. In-house training programs for CICS and IMS programming. Further details of each of these items follows.

Skeletal Programs, Maps, and Specifications

While not true prototype programs, these do contain the basic information needed in programs for the CICS and IMS environments. Three particular types were developed: CICS/IMS, CICS non-IMS, and IMS batch. All of these skeletal programs contain the following:

Identification Division with pre-formatted program-ID, author, date-written, and remarks section which includes program description and change log.

Environment Division which is left blank.

Data Division with PCB mask, error-screen layout for CICS, and abnormal termination parameters for batch.

Procedure Division with basic error logic (condition code processing, etc.), and required entry and termination calls.

The skeletal CICS map contains all the required macro statements with twenty-four screen lines defined. The programmer then changes it to include names, positions, lengths, and attributes.

Skeletal program specifications are available under CMS and contain all the required elements for program specifications. For example, it contains areas for files/segments used, sorts, report forms, copy features used, control card layout, error messages, etc.

Catalogued procedure specifications are in two parts, one containing the basic JCL statements required to execute an IMS program and another which is used to document the catalogued procedure. The basic JCL statements included are those for the database files, any required libraries, log files, and the execute statements for DL/I. The programmer then adds any JCL unique to the particular program to be executed.

The documentation skeleton, unlike the basic JCL, is not specific to IMS; instead, it is required for all applications. This skeleton consists of all required documentation for the catalogued procedure - programs executed, data sets and how they are used, restart/rerun instructions, output preparation and distribution, etc. The programmer completes this form under CMS, prints it, and delivers it to the operations support staff, who then generates the actual documentation for the procedure.

Copy Features

Many copy features were created to assist the inexperienced programmer with difficult routines. While the majority of these relate to IMS, many others exist. Some of the copy features that have been created are:

IMS Calls, including one for each function. They also provide SSA's, PCB's, and status checking.

String manipulation such as reformatting names.

Date reformatting.

Standardized report headings.

Subroutines

Subroutines were written to provide for commonly used routines. Examples of them are as follows:

COMPTERM - Unique to the university environment. This determines which of any two quarters was first in chronological order.

FPRNTLBL - Formats and prints 1 to 4-up labels.

GREGDATE - Converts a Julian date to a Gregorian date.

IMSABEND - Displays an abend message upon console and requires an operator reply so abends will not be overlooked.

NAMECUT - Reformats student name and shortens it to a given length without losing initials if at all possible.

Programming Guides and Standards.

Programming guides and standards were written in-house and cover the areas of CICS, IMS, VSAM, JCL, Easytrieve, and general COBOL programming hints and standards. The contents of these volumes can be divided into two basic subsets: 1. Programming guidelines and hints, and 2. Programming standards.

The programming guidelines and hints are voluntary and are designed to assist the programmer in coding uncommon routines and to provide a reference to the preferred method to use in certain common situations such as table searches, etc. These also include some tutorial material written in-house to supplement available vendor manuals.

Among the topics covered are: IMS concepts; IMS batch coding, IMS calls; CICS concepts; CICS coding; CICS BMS; common abends and actions to be taken; JCL for IMS; VSAM error handling; when and how to abend programs; available subroutines and their usage; Easytrieve/IMS; etc.

The programming standards are intentially limited but must be strictly followed. They address program design, coding, testing, and implementation. Some of the topics addressed are: naming conventions for programs, jobs, files, etc.; required program documentation; data element usage (e.g. counters must be COMP-3); editing requirements; error message format; paragraph names; error handling; structured coding requirements; unacceptable COBOL verbs (e.g. ALTER); required levels of testing; etc.

VM/370 Components

The various components of VM/370 are used to accomplish "card-less" programming and testing. Specifically, CMS and EDGAR are highly utilized. Each programmer has a terminal at their work station. The terminal is used to design, code, test, and document programs. As stated above, the programmer handles no cards.

While the full-screen editor is obviously a very powerful tool, two others are also worthy of special mention. The first of these is the CMS batch compile facility, which enables the programmer to do a compile in one or two minutes without having to go through OS/VS1. The second is a facility provided by our systems software group which enables output to be routed directly back to the terminal instead of being printed or punched. This has proven to save both time and money.

Another useful feature of CMS is that commonly used files such as program skeletons and catalogued procedure documentation skeletons can be kept in an area that is available to anyone. Therefore, a programmer simply copies the required file into his individual work area and makes the necessary modifications.

Data Dictionary

The data dictionary is the repository for nearly all of our documentation. For example, it contains file documentation, program documentation, system documentation, field usage documentation, and a great deal of cross-reference documentation.

Some of the things it allows us to do are: link files to programs, programs to catalogued procedures, reports to users, IMS segments to programs, etc.

As an example of how the dictionary is used consider catalogued procedure documentation. When the programmer has developed and tested a catalogued procedure, the procedure documentation shell is copied into his area and he completes it under CMS. When the documentation shell is completed, the programmer prints it and forwards the printed copy to the operations support group. This group then enters the information into the dictionary and prints the required reports. The result is the generation of all required user, system, operations, and control documentation, usually without the programmer actually writing a single line.

Peer Review

Peer reviews are used primarily in inspecting program code, but are also used on occassion to inspect designs and specifications. As soon as possible after the first "clean" compile, the programmer contacts his supervisor, the analyst who designed the program, and at least one other programmer to schedule the review, or walkthru. Usually, two or three days lead time is given. The participants receive a copy of the compiled program, a copy of the specifications, a copy of the program test plan, and a copy of the report or screen layout.

At the actual review session, each participant is given the opportunity to point out errors in design or logic, offer suggestions for improvement, etc. The programmer records all required changes as determined by the analyst. After the changes are completed, the analyst reviews the material again to insure that the changes were made as requested.

Experience has shown that this process leads to better structured, commented, readable, and maintainable programs. It is interesting to note that a remarkable similarity in style has evolved throughout the shop. A very important side benefit is the learning which takes place when other programmers review programs. Not only does the author receive some helpful hints about techniques, but the other participants also learn new techniques as well.

In-house Training

Two in-house training programs were developed, one for IMS concepts and coding, and one for CICS concepts and coding. The CICS course was developed by a member of our database team who was formerly our CICS support person. The IMS course was developed by members of our database team. Both of the courses are intended for beginners in CICS and IMS and not for the experienced individual. Both also resulted in reference manuals for use by the entire staff.

These courses have proven satisfactory for getting an individual started in the CICS or IMS programming environments and have provided the foundation to progress in reading and using more advanced materials.

As a footnote, we now find that we have reached a new dilemma, we have been fairly successful in raising the productivity level of both our inexperienced as well as our experienced programmers. So successful, in fact, that we can now produce programs faster than our relatively inexperienced analysts can prepare specifications. It appears that this will now be the next challenge we face as we continue to attempt to raise our overall productivity level.

TRACK IV
Small College Information Systems

Coordinator:
Elizabeth Little
Swarthmore College

The Implementation of Administrative Computer Systems in Small Colleges: A Roundtable Discussion. From left to right: Donna Clark Evancoe, Marymount Manhattan College; Elizabeth Little, Swarthmore College; Robert Denning, Pacific Lutheran University; and Michael Zastrocky, Regis College.

Albert L. Harris
Management/Systems Advisors, Inc.
Georgia

THE IMPLEMENTATION OF AN ADMINISTRATIVE COMPUTER SYSTEM IN A SMALL COLLEGE: THE MARYMOUNT MANHATTAN EXPERIENCE

Donna Clark Evancoe
Marymount Manhattan College
New York, New York

Computer technology has advanced to the point where it has become feasible for small colleges to purchase and maintain their own computer systems. Such an opportunity is, in many ways, very attractive to both college executives and operational managers. However, the potential for problems is very great, especially if inadequate attention is given to institutional needs and system capabilities and requirements. This paper describes issues and processes which were important in the selection and implementation of an administrative computer system at one small liberal arts college. Among the topics discussed are: system analysis, system design, selection criteria, institutional decision processes, implementation steps, user acceptance, and organizational impact.

Paper presented to National CAUSE Conference, December 1982 in Hilton Head, South Carolina

THE IMPLEMENTATION OF AN ADMINISTRATIVE COMPUTER SYSTEM IN A SMALL COLLEGE: THE MARYMOUNT MANHATTAN EXPERIENCE

Donna Clark Evancoe
Director, Planning and Management Systems
Marymount Manhattan College

Marymount Manhattan is a small liberal arts college for women in New York City. We have a student body of about 2200 students — 900 full time and 1300 part time; a faculty of about 55 full time and 125 adjuncts; and an administrative and support staff numbering about 100. In 1977 Marymount Manhattan received a 5 year grant under Title III's Advanced Institutional Development Program (AIDP). This grant included funding for a Management Information System (MIS) which led the College to the development and implementation of an administrative computer system. This MIS activity was designed and written by an external consultant but our college administrators strongly endorsed the need for computerization.

SYSTEMS ANALYSIS AND DESIGN

The first step in our MIS activity was to undertake a systems analysis of our administrative processes, which were, at the time, totally manual. The external consultant who wrote the MIS section of the Title III grant was re-hired in a consultant capacity to perform this systems analysis. He began this work in 1977. He met with our vice-presidents, directors, and other managers, both individually and in groups. The focus of the systems analysis was the "student flow." We concentrated almost exclusively on operations in terms of how they served students and how they processed student information. We first identified the operations we wanted to computerize and then defined how those operations functioned — or should function. One difficulty we had during this stage of our MIS development was a confusion abcut whether we were describing the way things happened or the way they ought to happen in a "perfect, computerized world."

We spent two years, off and on, on this systems analysis. We talked about procedures, flow charts, forms, data elements, reports, definitions, interactions among office — all the things that you're supposed to cover during a systems analysis. When we finished in 1979 we had a large book which documented in great detail the system needs of each office we wanted to computerize.

At the same time that the systems analysis was going on, the external consultant was encouraging us to learn other things about computers and the kinds of computer systems that were available to us. The vice presidents and a few others visited neighboring colleges to see how their systems operated. Through discussions with the consultant, reading, and site visits, a collective consciousness evolved regarding the kind of system Marymount wanted. We wanted an on-line, integrated system. The most frequently used analogy was that the registration and payment process for the students was going to be just like getting an airplane ticket — the student would walk up to counter, be enrolled in the classes she wanted, pay for the classes and walk away fully registered. So simple!

By the Fall of 1979 we were ready to define the specifications for the system we wanted. It was decided that we would put the specifications into an RFP (Request for Proposal) and solicit proposals from whatever companies wanted to bid. The RFP, drafted by our external consultant, identified:

1. That we were interested in purchasing compatible hardware and software;
2. That we wanted software that would allow us to computerize Admissions, Registration/Advisement, Financial Aid, Business Systems, and Alumnae/Development;
3. That we wanted an on-line system;
4. The data elements we wanted to capture;
5. The system capacity we estimated was necessary;
6. The hardware configuration we were interested in; and
7. The criteria we would use to evaluate submitted proposals

The RFP was sent to about 50 or 60 companies. We held a one-day Vendors Conference so that any company that wanted to could come to the college and ask questions. Proposals were due to us by February 28, 1980. We received 26 proposals — some for hardware only; some for software only; some for both.

SYSTEM SELECTION

To review the proposals, we established a Technical Review Committee of two vice presidents, four administrative managers, two faculty, and our external consultant. We used what the proposals said, site visits and/or demonstrations, and Data-Pro information to narrow down our choices.

By this time financial considerations had led us to the conclusion that we needed a system with pre-designed software which would not require a DP staff to maintain and which we could implement relatively quickly. As such, our discussions focused more and more on software considerations; hardware was not considered unimportant, but it was clearly secondary. Within this context, the following issues became the "working criteria" for the Committee's deliberations and decisions.

1. How fully is the software pre-designed; how much work would we need to do in order to use it?
2. How fully does the software meet our administrative needs?
3. To what extent do the various administrative programs interact with each other?
4. Can we manage this system without a DP staff?
5. What will the start-up costs and on-going costs be?
6. Is the system installed in other colleges? If so, how is it working?
7. Is one vendor responsible for both hardware and software?
8. What is the stability of the vendor company?
9. Is the hardware expandable and is the software upward compatible?
10. Are we limited to the "canned" programs and reports, or will we be able to generate our own?
11. Can the system be used for instruction and academic research, i.e., can it support such languages as FORTRAN and BASIC and standard statistical packages?

Using these criteria, we were able to narrow down the list of viable proposals from 26 to 17 to 10 to 7 to 3 to 2 to 1. The three were POISE software on a DEC machine, AIMS software on a PRIME, and COLLEAGUE software on a PRIME; the final two were AIMS and COLLEAGUE. The AIMS and COLLEAGUE systems are very similar; the deciding factor for us was that in the Spring of 1980, when we made our decision, we felt Datatel Minicomputer Company (DMC), the COLLEAGUE vendor, was a more diversified and stronger company than AXXESS, the AIMS vendor. This was extremely important to us because we knew we would rely heavily on the vendor for support; thus we chose the company which looked the most stable — DMC. (Let me say I'm not sure that that distinction between DMC and AXXESS exists anymore today.)

The Technical Review Committee made their recommendation to the Council of Vice Presidents, and the Vice Presidents endorsed the recommendation and forwarded it to the President. In June, 1980, the President gave us the approval to move into contract negotiations with DMC. During the summer we negotiated the contract and we signed the contract in early September. Finally, after three years of analyzing, visiting, and discussing, we were going to really do it!!

THE IMPLEMENTATION PROCESS

In order to implement the computer system we established the Office of Information Services under the Vice President for Planning. The Director of Computer Services, my colleague, was given responsibility for the hardware, peripherals, and operating system of the computer. He hired one computer operator working to assist him. I was named Director of Planning and Management Systems and given responsibility for the administrative software and its implementation.

One of the things outlined in the contract with DMC was the implementation schedule. We decided on a gradual process, beginning in January, 1981 in which the various modules would be implemented sequentially over a period of about 18 months. Our primary objective was to get certain student-related systems operational for the Fall, 1981 semester. Where to start was a significant decision for us. Some wanted to begin with Admissions because that was the starting point of the student. Others wanted to start with the Registrar because that was the central point of the student record and all other things must relate to it. In the end, the President made the decision that we would start with Admissions. Exhibit 1 illustrates the sequence in which we implemented the 11 modules of our system.

Implementation of each module really consisted of three stages: user introduction and training, user hands-on practice, and live operations. User introduction and training consisted of group meetings of professional staff from the office directly involved in the operation, representatives from other offices which worked closely with the office being computerized and myself. We would review their current needs and office practices and procedures and go over the software documentation. Then a representative from DMC would come on a pre-installation visit. She would meet with the same group of people, and describe the conceptual design of the module, give a brief demonstration of the module, and answer any questions about the module. For the next three to four weeks the users were encouraged to try the module out, and see what it did in the test account.

The user hands-on practice stage began with the second DMC visit. The DMC representative would slowly and carefully demonstrate each operation in the module to the staff who would be using it. By this time the staff was expected to be familiar enough with the module to have specific questions about how to handle this situation or that procedure which were not clear or not mentioned in the documentation. After this DMC visit, it was up to the user office to become proficient in operating their software. I encouraged them to take a variety of cases from their files and begin using the test account in the same manner as they would use the live account. During this testing they would often find things that didn't work the way they expected or circumstances that they didn't know how to handle on the computer. These questions were called into the DMC customer service staff, whose primary purpose is to deal with such matters. The customer service staff gave us both factual answers about the software and opinions and advice about the ways in which we might want to apply the software.

The live operations began when I felt the office director knew what he or she was doing and when the director expressed the readiness. I worked with the office to determine what tasks had to be done and the order in which they should be done in order to become operational. During this phase users usually slowly developed a feeling of ownership of the module.

The user introduction and training stage usually lasted 6 - 10 weeks; the length of the user hands-on practice stage varied greatly — depending upon the commitment the director of the office had to the computerization effort and upon the time during the fiscal or academic year — from 5 weeks to 20 weeks. Exhibit 1 also shows how these stages occurred for each module at MMC.

USER ACCEPTANCE AND IMPACT ON ORGANIZATION

My judgement is that once people got over their initial anxiety and became comfortable with what they were doing, they accepted and, in fact, supported the computerization effort. There are three reasons, I think, for this. First, we have been very lucky to have had very few and relatively minor hardware problems. Thus, the system has been available to our users about 90% of the time. Second, the software package is good and is very easy to use. And third, the computer takes the drudgery out of many jobs — like counting students, addressing envelopes, and producing monthly budget reports.

The computer has become an integral part of Marymount Manhattan's administrative operations. The impact of the computerization is felt in many ways throughout the organization. But there are, I think, three ways in which the computer is having a major, significant impact on the administrative organization of the college.

The first major impact that computerization has had on Marymount Manhattan is the creation of a permanent new box on the organizational chart for the computer services area. We did not expect this. When we began this venture, we believed that the Office of Information Services would be scaled down after the installation period and that supervision and on-going maintenance of the system would be part of the workload of a Director and a secretary who worked for the Planning Vice President. (Recall one of the decision criteria we had: can we manage the system without a DP staff.) I now believe that we will not be able to achieve the reduced staffing unless the College accepts a much lower level of service and response than they have become accustomed to. The workload on both the hardware and software sides is tremendous if the system is to be kept running efficiently and effectively.

The second major, and most important, impact that computerization has had on the institution is the increased communication and coordination among offices that is developing. Because it is a unified data base system, no office can go about its business without concern for the other offices' needs and practices. When offices do undertake an independent action, problems usually occur and we must spend a few days unravelling them. Examples of the interlinkages are 1) names (we all have to agree on spelling rules for such names as O'Connor and McCormick or else the name search facility is useless and alphabetical reports are messy) and 2) general ledger numbers (the business office cannot just create new numbers without advising the people who link into the numbers like Development or Financial Aid). These are simple examples; there are others that are more complex. The point is that the computer is forcing us to work together and coordinate administrative operations. Eventually, this will lead to both greater management efficiencies and better service to the student.

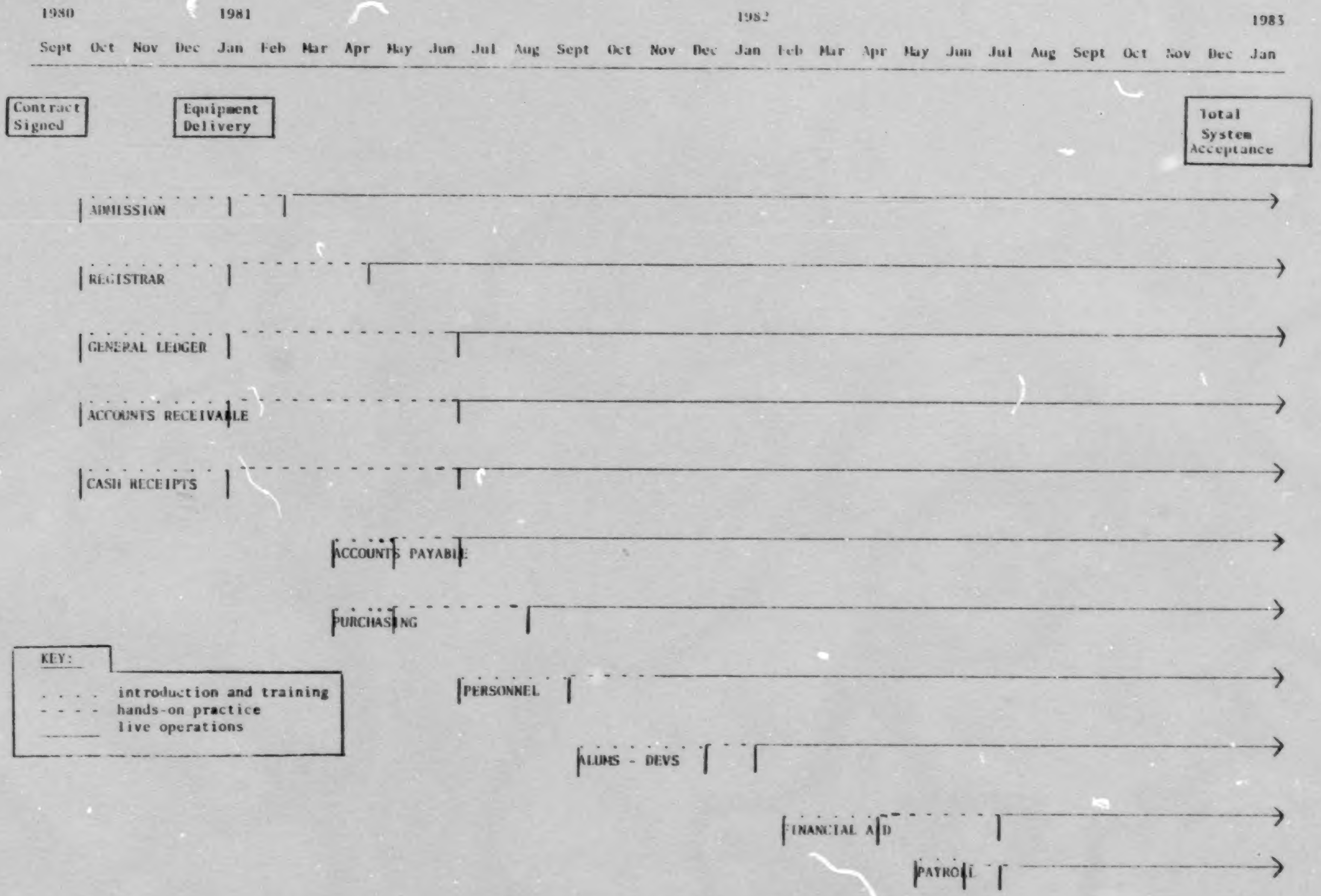
A third major impact that computerization has had on the institution is in terms of report generation, and this impact is just developing. Since we no longer have to do manual counts we can produce reports that have more than two dimensions. We can also produce reports which combine data from different areas for example payroll data and instructional load, or budget expenditures and majors enrolled in each department. Our data base has tremendous potential and the report generation language is easy to use and very powerful. The administrators at Marymount Manhattan are learning how to use this tool and are just beginning to appreciate its potential. The long term benefits of this will be tremendous.

*****

December, 1982

EXHIBIT 1

IMPLEMENTATION STAGES FOR EACH MODULE OF MARYMOUNT MANHATTAN'S ADMINISTRATIVE COMPUTER SYSTEM



PLANNING INFORMATION FLOW FOR A PROACTIVE INSTITUTION USING PROPRIETARY SOFTWARE

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Director, Management Information Services

Regis College

Denver, Colorado

Alternatives to home grown administrative information software have become common. Turnkey packages have built track records in many institutions during the past 10-15 years. How does an institution which is proactively changing and planning its future decide which package best fits its current and future needs? Can 90% of the institutional needs really be met at a 10% cost? What problems can be expected during implementation? How does an institution organize itself for the future? Each institution must ultimately answer these questions as best it can. The experiences of Regis College in selecting an administrative software package, THESIS, might prove useful to the institution about to take the plunge into proprietary information systems.

INTRODUCTION

Regis College changed dramatically during the years from 1968 to the present. From an all male predominately 18-22 year old student body, the College now serves men and women from 18-80 years old. A second campus in Colorado Springs provides new degree opportunities for people in a highly technical and growing area. Adult degree programs have extended educational opportunities to persons who were largely ignored in previous years.

In the midst of these planned changes the President of Regis College, Rev. David M. Clarke, S.J., became concerned that the current administrative computing system did not adequately provide the information needed to effectively guide management decisions in operations and short and long-range planning.

The current system evolved during the previous fifteen years from a manual system to an on-line interactive EDP system. Software was developed, primarily in-house, by people who were busy putting out daily brush fires and who designed and built the software in their "spare time." This resulted in almost an annual turnover in Computer Center staff, poor documentation and basically a "system" which was unable to meet the ever increasing needs of a growing and changing institution.

Serving 1500 adults in 22 off-campus sites caused many management problems. Adding to the situation was an adult course schedule that changed every 5 weeks requiring registration, billing, grading and transcripting to be done almost continuously.

PROJECT OBJECTIVES

The President assigned Dr. Michael Zastrocky as the project leader and together they outlined the broad objectives and goals for the project. These were:

- Determine the current information needs of the institution.
- Gather ideas on expected future information needs (through the next 5 years).
- Identify possible strategires for meeting those needs.
- Establish criteria for measuring the effectiveness of each strategy in meeting identified needs.
- Measure each strategy against the established criteria.
- Make a recommendation on which strategy should be pursued based on the measurements.
- Design an implementation strategy that meets the needs of Regis and is especially sensitive to the people issues and time constraints.
- Design an evaluation and monitoring process that allows for planned changes to the information system.

ASSUMPTIONS

The following assumptions were made:

- It would not be cost effective to redesign the current software to meet the College's current and planned future requirements.

- All users would be put on "hold" during the next year (1981-82) while the study was conducted and final decisions were being made. (This meant that users would essentially have to get by with current system capabilities, to avoid putting more time and money into existing software.)
- The major strategies to be pursued would involve "Turnkey" (complete system) packages. (Although some custom software designs would be explored to gain insights and make comparisons.)
- The institution would shop for the software package and vendor that best met Regis' perceived needs. Hardware would be considered only as the tool to drive the appropriate software.
- Regis would maintain the "architect's role in the system integration; the software vendor would build the system and maintain the software and Regis would control the operation of the system.
- Timeliness of performance would be a major concern. The ability of the software (and appropriate hardware) to be delivered in a timely fashion would be used in evaluating the packages.
- The depth of the software organization and its ability to support Regis in the future would be important.
- The package chosen would be viewed as a five year solution. After 3-5 years changes in the institution, software and hardware might require new visions.

IDENTIFICATION OF USERS' REQUIREMENTS

The project leader met with the President and his staff early in the project to identify the overall goals and major information needs for the College. He then met with each presidential staff member to isolate major needs for each presidential staff member's area of responsibility. He then met with each user several times to identify users' requirements. The reason for several meetings was to give users time to think about needs and to make changes as necessary. He then met again with each presidential staff member to ensure that the Summary of Users' Requirements accurately defined needs and supported the goals of their area of responsibility.

IDENTIFICATION OF STRATEGIES

During the fall semester, 1981/82, the project leader spent considerable time talking with people at other institutions and software vendors. Some contacts were made based on personal knowledge. Others were made based on information given him from members of a planning group, the Regis College National Commission Task Force on Technology, Dr. John Minter, Mr. Charles Thomas and from the President of Regis. Initial contacts were made and conversations outlined on a form that listed the following software characteristics:

- Modules available
- Overall quality of package
- Quality of documentation

- Support from software vendor
- Need for major changes in the package
- Ease in training Regis staff
- Cost
- Hardware needed
- Strengths/weaknesses of hardware
- Local support for hardware
- Length of conversion and implementation time
- Miscellaneous comments
- Reliability and dependability of hardware

Literature and phone conversations with vendors provided additional information on the packages. The characteristics of each package were measured against the Regis College Users' Needs.

Those strategies which seemed to have the most potential for Regis were explored further by phone calls to other institutions and visits by the project leader to see the package in operation. In all cases the primary concern focused on the ability of the software to meet Regis' present and future needs; hardware issues followed. Schools which exhibited characteristics similar to Regis in curriculum, history, administration and size and which were using a package that might be used by Regis were visited.

EVALUATION CRITERIA

The criteria used to evaluate the various strategies include the following:

- Does the software match the user's needs as outlined in the Summary of Users' Requirements?
- How difficult would it be to modify the software to meet Regis' needs?
- Does the software supplier have adequate resources to support their software today? Five years from today?
- Are other users of the software satisfied?
- Does the software have the ability to grow to a larger system as the Regis needs change and expand?
- Does the software require a high degree of technical knowledge on the part of the users?
- Will the software supplier provide adequate support in the installation and training phases?
- How difficult or easy is it for weaknesses in the software to be overcome to meet Regis' needs? (For example, it's not as easy to overcome the weakness of a Turnkey Package which is missing a marketing module as it would be to overcome a weakness such as a missing inventory module for keys.
- Is the software data based?
- Does the hardware adequately match the software?
- Does the hardware have the ability to grow as the software (Regis needs) changes and grows?
- Does the hardware have adequate local field service support?
- Are other users of the hardware happy with the hardware?
- Intuition and prayer. Does there seem to be a good match between people resources, software resources and hardware resources with Regis?

- Cost considerations.
- Does the hardware have a reputation for little downtime? (Is it reliable and dependable?)

A final recommendation was made to the President to utilize the services of Computer Management Services, Inc. and the THESIS package. This recommendation was based on the overall management strength of CMSI and their perceived ability to meet Regis' needs in a timely fashion. There was also a "gut feeling" that the THESIS package would allow other software packages like the DATABASE TAGS package and Execucom's IFPS package to easily interface THESIS and provide additional information and flexibility.

Administrative Computer Systems in Small Colleges

by

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Pacific Lutheran University, a college of liberal arts, was founded in 1890. The University is located in Tacoma, Washington with an enrolled headcount of 3900.

The computing history of the University began in 1965 with an IBM 1401. The software was designed and maintained by computer center staff. Since that time the University has changed hardware twice and has converted the existing software systems to the new hardware.

In 1979 the University, in updating its planning, recognized the need for an upgrade in computer hardware to support the academic and administrative needs. A committee was established to define the needs of the University and the selection criteria to be used. The committees first recommendation was to purchase two computers and to dedicate a computer to each faction of the University. This was not accepted as some members of the University wanted to see a machine with 32 bit architecture. The final recommendation for hardware was to purchase a VAX 11/780 by Digital Equipment Corporation to support both academic and administration.

A very important consideration in the decision for new computer support dealt with the software. The option considered were as follows:

1. Convert existing program software
2. Write new software
3. Purchase package software

In evaluating these options it was important to keep in mind the needs as defined.

1. On-line system support
2. Speed and Accessability
3. Data Management System
4. Administrative Information System
5. Word Processing

When considering the needs it was obvious that options 1 & 2 were both time consuming and costly. The committee then set out to evaluate the software packages available. The software under evaluation included SOARS, CMSI, AIRES, SOLUTIONS & POISE. The decision was made to purchase the POISE software and install it on the VAX 11/780. The two key reasons, beyond the defined need, for choosing the POISE software were user friendly software and system flexibility.

The conversion plan for administrative systems called for the installation of the VAX 11/780 hardware by April, 1980. The software was to be installed by POISE beginning on May 1st. This plan would provide a 90 day parallel conversion. The hardware was installed on schedule, however, the software required the release of a new basic language that was being tested by Digital Equipment Corporation. This delayed the installation of the software until late June, 1980. With conversion starting in July, 1980 the benefits of parallel processing were impossible.

The implementation of the new software on the VAX 11/780 was a true pioneering effort. The software was designed to run under RSTS and required extensive conversion to run under VAX/VMS. The successful installation of the following systems was completed by the date indicated.

*	Registration	July, 1980
*	Payroll	August, 1980
*	Admissions	September, 1980
*	Fiscal Systems:	
	Cash Receipts	July, 1980
	Accounts Payable	July, 1980
	Journal Entry	July, 1980
	Budget	September, 1980
	Fiscal Reporting	September, 1980
*	Student Billing	January, 1981
	Personnel	August, 1980
	Financial Aid	August, 1980
	Residential Life	August, 1980
	Word Processing	July, 1980

* - systems that were installed by POISE. All others were developed by the computer center staff using POISE Data Management System

There were two major impacts imposed by the new on-line systems. The first being the absorption of data entry and maintenance of files by the user department. The second was relieving the fear of & responsibility for the on-line data files. These were dealt with through extensive training which has created a very positive acceptance of the system by the user departments.

To date many more systems have been developed using the POISE Data Management System. We have found that the key element in the University use of this software is "flexibility". We are not confined to a structured program that imposes restrictions that prohibit change by the user. We are excited with the enhancements that are being made by the POISE Company for the VAX and look forward to the use of such packages as Visicalc and Datatrieve. They will only strengthen the capabilities of the user at Pacific Lutheran University.

The Academic plan included support for the Math, Science and Business Divisions. In the Fall of 1980, the University began offering a degree in Computer Science. Since that time the new major together with the other divisions have increased the student usage from 300 to over 1200 accounts. New academic interests are being developed everyday. The computer center has also developed some instructional packages using the POISE Data Management System.

The growth in the use of the computer on campus has exceeded all planning expectations. We are currently considering additional hardware to provide additional support to the user community on & off campus. The decision to install Digital Equipment Corporation VAX 11/780 hardware and POISE software has been a major step forward in computing at Pacific Lutheran University.

Implementation of Administrative Computer Systems:

The Swarthmore College Experience

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This paper reviews the process used in selecting and implementing a proprietary administrative information system at a small liberal arts college. It describes the characteristics of the institution and the history of computing at Swarthmore College. The selection of both hardware and software is discussed. Implementation of the software system is addressed from two prospectives -- planned and achieved! Finally, comments are given on both the successes and pitfalls so that, hopefully, others will profit from these experiences.

Implementation of Administrative Computer Systems: The Swarthmore College Experience

Elizabeth R. Little
Swarthmore College

HISTORY

Swarthmore College, founded in 1864 by members of the Religious Society of Friends as a co-educational liberal arts institution, is located southwest of Philadelphia. It is a small college by deliberate policy and present enrollment is about 1300 students. The teaching faculty numbers 135 and has an administrative staff of 450. Swarthmore College also offers a degree in engineering.

The College acquired its first computer - an IBM 1620 - in 1964. In 1968, with funding from the National Science Foundation, Bryn Mawr, Haverford and Swarthmore Colleges formed the Tri-College Computing Center and purchased an IBM 360/40. This installation was located on the Haverford campus some 15 miles from Swarthmore. An IBM 1130 was installed at Swarthmore to be used as both a stand-alone computer and to communicate with the IBM 360 at Haverford. In 1974, again with NSF funding, Swarthmore acquired an IBM 3780, five IBM 5100's and five Tektronics terminals. The IBM 1130 link to Haverford was replaced by a connection to a larger IBM 370 at UNI-COLL.

By 1979, a number of locally developed administrative packages were being used on the IBM 1130 and at UNI-COLL. An admission's and registrar's system developed on the IBM 1130 were converted to UNI-COLL in 1980 because of inadequate processing power and lack of storage. A fairly sophisticated Alumni/Development system for biographical and gift recording had been developed using Mark IV and ran on the IBM 370 at UNI-COLL. Other administrative applications included a Tri-College library periodical data base, several programs for Building and Grounds, the student payroll system and a voucher check program.

SELECTION

Frustrations with the computer environment felt by faculty and administrators led to the formation by the President of an ad hoc committee to study the campus computing needs in Fall 1979. The Committee worked under two basic premises - 1) that one machine could serve both the academic and administrative commmunity and 2) that the administrative software should not be development locally both purchased from a software house. A consultant worked with the ad hoc Committee to formulate an RFP that was sent to 20 computer vendors in the spring of 1980. By the summer of 1980 the numerous vendor proposals had been evaluated by the committee and the choices had been narrowed down to IBM, HP, Digital and Prime.

Formal hardware vendor presentations were made to faculty and administrative staff in the fall. While several administrative packages were looked at the three most closely examined were from POISE, DATATEL, and AXXESS. The Computing Center staff worked with each administrative area to determine their functional needs; what their current system, if any, gave them and what was available or unavailable from the various packages.

Considerable time was spent by both computing center staff and people from the administrative offices reading software documentation, attending software demonstrations, and calling and visiting other institutions that had installed the systems that were being considered. In December, final contracts were signed for two PRIME computers networked via PRIMENET. A PRIME Information 1000, with software developed by AXXESS, Inc., was selected to handle administrative systems, and a PRIME 750 was selected for academic computing. Original plans called for a single computer; however, it was finally determined that, with a marginal expenditure increase, two computers could be obtained and would provide improved data security and backup capability. See Appendix A for the current hardware and software configuration.

IMPLEMENTATION: PLANNED

Early in January 1981 administrators from each area met to discuss the events of the months to come. A document outlining by weeks and months the mutual assignments for both the Computing Center and the administrative offices was distributed. Each department had to select a computer liaison to work with the Computing Center staff. Each member of the Computing Center staff was assigned to a particular department. Documentation on the administration system was handed out. By the end of February individual departments were to have read the documentation and scheduled meetings with their counterpart in the Computing Center. Written questions from the offices had to be given to the Computing Center one day before any scheduled meetings. The Computing Center staff acted in a liaison role between the admininstrative offices and the software vendor - AXXESS, Inc. The Prime Information 1000 was scheduled for installation in March as were the communications lines and administrative terminals. Training of the administrative staff was scheduled. Demonstration modules with a small data base would be available for this instruction. The plan continued rather ambitiously to April with the conversion of registrar's and alumni/development data. Data entry for the other offices was to begin. In May, the initial testing of the admissions system and the alumni/development system was to begin. The Admissions Office was to go live in June. On July 1 the Controller's Office encompassing six modules was to go live. Final testing of all other modules was scheduled for August. Everything was to be running by September 1 and administrative computing on the IBM 1130 and at UNI-COLL would stop. The IBM 1130 and 3780 would be sold.

IMPLEMENTATION: ACHIEVED

In fact January, February and March went pretty much as planned but April saw the slow demise of the plan. The time needed to actually learn what the software did and how best to use it was underestimated. There were problems with "bugs" in the system. Just getting people accustom to an interactive system, terminals, and new terminolgy was hard. The real problems of the relationships between the various modules, how the data flowed, who "owned" or had the maintenance rights to what data, and the establishment of support files that the entire college would use had to be worked out. Just the logistics of scheduling meetings where all departments were represented seemed at times impossible. More modifications to the system had to be made than expected. A Computing Center Open House on May 1 proved, in many ways, to be a major turning point. A lot of wine, cheese and demonstrations of both the academic and administrative systems seemed to convince people that computing could be fun! People started to get truly excited about the possibilities. In June the Admissions Office did go live and proceeded to load 9,000 prospects into the admissions file from ETS tapes. The Controller's modules were running for the start of the new fiscal year on July 1. The conversion of the registrar's data from both the IBM 1130 and UNI-COLL into the new system took place in August and the student affairs/housing office was up. The month of September was spent in converting all the biographical data and the six years worth of giving histories and giving summaries to the new system. The IBM 1130 and 3780 were sold and out the door sometime in October. By December a number of other applications were written locally for the Buildings and Grounds department. The General Mailings program was being used by a number of departments.

The advent of 1982 found the ever elusive "BUG" continued to run from one program to the next and complete fumigation always seemed just around the corner. Major problems were found in the data converted from the old registration system to the new system. A new controller in the new year caused numerous changes needed by the start of the next fiscal year. Financial aid information was finally entered in late May and early June, 1982. A new chart of accounts was established for the new fiscal year. For the first time in the history of the college, tuition bills were not done by hand and were sent out on schedule in the middle of July.

During the spring of 1982, system response time went from very good to extremely bad almost over night. The acceptance of the system, the increase in number of users, and the true realization of the power of this tool made a major hardware upgrade necessary. In the summer the administrative machine was upgraded from a PRIME Information 1000 to a PRIME Information 750 with more memory and ports thereby doubling the capacity. See Appendix A for current configuration.

COMMENTS

The enthusiam for computing by all segments of the administrative offices is rewarding in itself. These offices are in control of their own data and the timeliness of their reports which is a comfort both to them and the computing center. The key to success was the appointments by the departments of computer liaisons. These people, with no previous computer experience, helped the computing center and the offices to feel that everything was a joint effort instead of an "us against them" environment. In a little over one year all administrative departments are using the software systems to better their products and increase their productivity.

Time was the biggest pitfall. More time in planning, training, documentation, and testing would have elimentated many problems. On the other hand we would probably not be as far along if we had spent more time in any of these areas. Certainly one lesson that was learned time and time again was to have everything between users and the center and the center and the software vendor in writing! Conversations are nice but written confirmation of those discussions make life easier in the long run.

When asked if we would make the same decision on hardware and software today that we made two years ago, the answer is yes! But now we know how to really make it work.

APPENDIX A

Swarthmore College

Administrative Hardware Configuration

PRIME Information 750
- 2 megabytes main memory
- 1 - 75 ips tape drive
- 2 - 300 megabytes disk drives
- 48 - ports
- 1 - 750 lpm printer
- 4 - Diablo 630 letter-quality printers
- 50 - administrative terminals

Gandalf PACX III communications equipment

Administrative Software

Developed by AXXESS, Inc.
200 Central Ave.
Mountainside, NJ 07092
201-232-7600

- Admissions
- Financial Aid
- Student Affairs
- Registrar
- General Ledger
- Accounts Receivables
- Accounts Payable
- Purchasing
- Payroll
- Personnel
- Alumni/Development
- Word Processing

A MANAGEMENT RESEARCH SYSTEM
DESIGNED FOR THE PRESIDENT
OF A SMALL, LIBERAL ARTS COLLEGE

Dr. John E. Weems, President
Dr. LaRose F. Spooner, Assistant to the President
Meredith College
Raleigh, North Carolina

Decision making, planning, managing, and evaluating are critical functions of a college president. With these administrative functions in mind, a special type of information system, denoted a Management Research System, was designed which would make available to college presidents objective and timely information on all aspects of their colleges' operations. The Management Research System has several unique features:

1. It is designed for the president of a small, private, liberal arts college;
2. 90% of the research studies are longitudinal in nature, covering a five year period;
3. An interpretive summary accompanies each management research study highlighting trends, providing indicators and revealing college directions;
4. The management research studies and interpretive analyses are complied by categories and time of presentation and published in six statistical notebooks. These books serve as the basis for, and lend credibility to the president's reports to all constituents of the college. They further serve to enable faculty members, administrators and members of the Board of Trustees to become better educated about their institutions and to make better policy decisions.

Introduction

The environmental, economic and attitudinal conditions surrounding higher education have undergone significant changes in the past twenty years. As a result of these changing conditions, it has been necessary for academic institutions to shift their focus from one of rapid growth to one of careful management of institutional resources. Thoughtful planning, rational decision making, effective management techniques and objective evaluation have always been important functions in college administration. Today, however, as institutions are called upon to "achieve change and vitality in a no-growth situation," (McCorkle, 1977) these administrative functions have become more important than ever. Penrod and Wasileski (1980) state "the coming decade will be one of accelerated change and limited resources. The pressures of continued budgetary constraints will be felt in every phase and at every level of the academic community and responses to these pressures will, in large measure, determine the complexion of private higher education into the next century." They warn also of "the abrupt change from a relatively stable environment to one so volatile," and "as turbulence in the environment intensifies." In the next decade, colleges and universities will be faced with the serious challenge of remaining healthy and fulfilling their educational mission while confronting these difficulties.

Private higher education is especially vulnerable to changing economic conditions. Today, it is difficult for tuition increases to keep pace with inflation rates, for expenditures to be reduced in proportion to declines in enrollment, and for the tuition differential between public and private institutions to remain constant. Administrators and board members of private institutions, particularly small, private colleges, are becoming increasingly concerned about the future of their institutions and are devoting greater attention to the process of decision making in the planning, managing and evaluating of the institution. In such institutions, the president of the college serves as the chief planning officer, the person making the critical decisions that will determine the future of the institution. The president is the one who takes the lead in establishing the rationale for the planning process, in deciding among alternative needs, in allocating resources, and in providing for the efficient operation of the institution.

Absolutely essential to the successful execution of these functions by the president is the availability of accurate, timely, and historical information concerning all phases of the college's operation. The "seat-of-the-pants" administrative style that met with some success in the 1960's and 1970's will not likely work in the 1980's. Academic administrators have little enthusiasm for "winging it" today (McCorkle, 1977). Successful planning and decision making are administrative functions which require the availability of appropriate information. Topping (1981) asserts "the 'winners' in the '80's will be those who can react quickly to good, accurate and timely information."

In response to this need, academic administrators are increasingly turning to information systems as one means of supplying this information, and consequently, improving their capabilities for decision making in planning, managing and evaluating. This paper describes a special type of information system designed to meet this need for a particular institution of higher education.

The Design of the Management Research System

The design of this information system, denoted a Management Research System, is based on the premise that timely, accurate and clearly-presented information is essential to decision making in the planning, managing, and evaluating functions of the president of a small, liberal arts college. Success in the administration of higher education is consistently characterized by the efficient and effective use of available resources, chief among which is accurate and timely information.

Therefore, it seemed logical to create a system that would present pertinent information to the president at the critical points in the decision-making schedule. Such a system supports Williams' (1978) view that "Decisions are increasingly based on systematically gathered data subjected to quantitative analysis. This approach to administration requires accurate, reliable information about an institution's fiscal and human resources, current operations and future programs."

Against this background, a model was derived which involved consideration and inclusion of the following features.

1. Presents relevant information for decision making and, where appropriate, alternative courses of action.

The Management Research System contains information grouped into categories corresponding to areas of data-based decision making. Within each of the categories, individual management research studies are prepared giving statistical and interpretive information for each category.

2. Synchronizes the presentation of information with the decision making schedule of the president.

Timetable for Presentation of Information

Categories of Information	Time of Presentation to the President
Student charges, Financial and Enrollment Projections	August
Endowment and Investments, Budget and Resource Allocation	September
Faculty Salaries, Faculty Tenure and Promotions	January
Admissions, Retention, Enrollment, Financial Aid, Continuing Education, Alumnae, Library, Faculty Profile, Profile of Graduates, Trustees, Space Utilization	March
Academic Departments, Faculty Course Loads	June
Financial Health of the Institution	July

On some occasions there is a need for certain information prior to the specified date. On these occasions, individual studies are prepared and presented to the president at the time required. Likewise, the need for much of the information reoccurs at various times during the year. Therefore the system is designed so that the information is available at the earliest required point in time, and then remains readily available for future reference.

3. Presents information in a longitudinal form, when appropriate.

This feature of the Management Research System enables the president to compare statistical information for several years and detect trends and directions of the college. The longitudinal studies provide historical and current data and serve as a basis for projections.

4. Provides an interpretive summary with each statistical study.

Each management research study is accompanied by an interpretive summary giving the purpose of the study and the source of the data being analyzed. These analyses provide explanatory notes for each descriptive study, highlight trends, describe indicators and suggest alternative courses of action, where appropriate.

The interpretation and analysis of each study is an integral part of the Management Research System. While the individual management research studies provide the quantitative half of the system, the interpretive summaries serve as the qualitative portion of the system.

5. Presents information in a concise and usable format.

Data for management research studies are obtained from computer generated reports, internal college documents, professional journals, and other sources. The data are analyzed, presented as a one-page management research study, and accompanied by a corresponding one-page interpretive summary. Each study is prepared, using photo-reduction, if necessary, and presented on two facing pages. This format enables the reader to study the data and consider the interpretation simultaneously. An example of one such study is given at the end of this text.

6. Organizes the information by time of presentation into six statistical notebooks, and

7. Makes information available to other college personnel and various constituents of the college.

As with any system, the organization of the Management Research System is critical to its usefulness and value. Two factors played a prominent role in the selection of a notebook format for the Management Research System. If the use of the information contained in the Management Research System were to be confined solely to the president, the organization of the system would have been somewhat different. Information could have been presented as single reports corresponding to the decision-making schedule of the president and later bound into a single volume.

However, the management research studies and interpretations, while prepared specifically for the president, have value and use to other members of the college community. Faculty, administrators, members of the Board of Trustees, potential donors and other interested constituents of the college have appropriate portions of the information shared with them. With this in mind, it is important that the design of the system enable the president to pass on to these persons relevant information concerning the college, its status, and its statistical history.

A thorough examination of the president's data-based decision-making schedule revealed a natural grouping of six major periods. These times and areas of decision-making are outlined on the following pages.

Taking into consideration these two important features, the format for the Management Research System was selected to be six statistical notebooks, bound and titled to reflect their contents. This format enables the individual studies and interpretations to be readily available for immediate use and for historical purposes.

A description of the six statistical notebooks, their contents and audiences follows.

The first of these notebooks, entitled The President's Message, is published in August of each year. This notebook contains studies on financial, enrollment and academic trends. In addition to these longitudinal studies, this notebook includes the president's personal plans and projections for the college for the future.

This notebook receives the widest distribution of the six books published. It is shared with faculty, administrators, members of the Board of Trustees, interested constituents of the college and prospective donors and supporters of the college.

The second notebook published, Budget and Resource Allocation Analysis, contains an appraisal of the financial statement of the college. This notebook is prepared upon receipt of the official financial statement for the college and is published in September of each year. The studies in this notebook are prepared for the president and vice president for business and finance as a summary of the financial statement and as an aid in the planning and budgetary projections for the following year. The Budget and Resource Allocation Analysis notebook contains confidential information and is distributed only to members of the Board of Trustees at their semi-annual meeting in September.

The third notebook contains information relating to faculty salaries, tenure and promotion. This book, entitled Full-Time Faculty Salaries and Tenure, is prepared from information contained in the budget control document and is published in January of each year. Comparative studies from other institutions and from the American Association of University Professors is included with studies of Meredith College. This notebook includes confidential information and is distributed only to members of the Board of Trustees at their semi-annual meeting in February.

Profiles is the fourth in the series of notebooks prepared by the President's Office. This book gives a general profile and presentation of the college for the current academic year, contains studies on all phases of campus life, and is published in March. Profiles receives wide distribution to faculty, administrators, members of the Board of Trustees and other interested constituents of the college.

The fifth statistical notebook, entitled Departmental Studies is published in June immediately upon completion of the academic year. The studies in this book relate to productivity and expenditures by academic departments, with information secured from official class rolls, the college financial statement and grade rosters. These studies are used in departmental planning, projections, evaluations, and accountability. Departmental Studies is distributed to the faculty, administrators, and members of the Board of Trustees.

The final notebook in the series is entitled Assessment of the Financial Status of Meredith College. This notebook is prepared in July upon receipt of comparative data provided by the National Association of Colleges and Universities Business Officers. The source of information for the studies in this notebook is obtained primarily from the official college financial statement. This book aids in the appraisal of the college's financial health and highlights the fiscal strengths and weaknesses of the institution. This notebook is distributed to faculty, administrators and members of the Board of Trustees.

8. Designed specifically for the President of Meredith College.

The features of the Management Research System are those suggested by the literature, other college presidents, the personal experience of the author, and those of the President of Meredith College.

While this system was designed specifically for the President of Meredith College, a review of the system by selected college presidents indicated this system to be an adaptable model for institutions similar to Meredith College in size, structure and mission.

Conclusion

The Management Research System was designed to furnish the president of a small, liberal arts college with timely and accurate information to be used in the decision-making process.

The development of this system reaffirms the view of Harvey (1976) that "each institution of higher education needs an effective radar system to alert policy makers to impending danger." In addition, this system serves as an important administrative and educational tool not only for the president. but also for other college administrators, faculty, and members of the Board of Trustees.

The design of this system reflects the fact that an information system is an extension of the institution of which it is a part. The Management Research System developed for the President of Meredith College was uniquely designed to fit the institution, the president of the institution and the needs of the current time.

Shared Prospective Applicants

Profiles 1980-1981

1981 FRESHMAN CLASS

Institutions, in addition to Meredith College, receiving ATP Reports as requested by students

College	Type	Number	Percent	1981-82 Tuition Room and Board
Meredith	4 yr. priv.	1,448	100	4,000
UNC-Ch. Hill	4 yr. pub.	631	44	2,649
N.C.S.U.	4 yr. pub.	453	31	2,608
E.C.U.	4 yr. pub.	379	26	2,168
Appalachian State	4 yr. pub.	300	21	1,998
Peace College	2 yr. priv.	271	19	3,990
UNC-Greensboro	4 yr. pub.	234	16	2,195
Wake Forest Univ.	4 yr. priv.	230	16	5,745
UNC-Wilmington	4 yr. pub.	163	11	2,397
UNC-Charlotte	4 yr. pub.	112	8	2,104
Salem College	4 yr. priv.	107	7	6,245
Duke	4 yr. priv.	89	6	8,412
Campbell Univ.	4 yr. priv.	88	6	4,889
St. Mary's College	2 yr. priv.	88	6	5,675
Atlantic Christian	4 yr. priv.	65	4	3,978

Management Research System

Office of the President Meredith College

Publication: Profiles

Date of Publication: March

Circulation of Publication: Trustees, Administrators, Faculty, and Others

Title of Study: Shared Prospective Applicants

Source of Information: College Entrance Examination Board

Description of Study:

It is advantageous for a college to have information concerning other institutions to which its applicants are applying. The Admissions Testing Program (ATP) of the College Entrance Examination Board will provide subscribing colleges with a list of those institutions, in addition to the parent institution, receiving SAT scores of students at the student's request. This list gives a general indication of those colleges being considered by students who are also considering the parent institution and, therefore, reflects the college's main competition for students.

Tuition is an important consideration in a student's selection of a college. Consequently, it is critical for an institution to maintain a fee structure that has the least possible differential with close competitors.

The accompanying study shows the four most competitive institutions for applicants to Meredith College are state supported schools. Of the top nine competitive schools, seven are state supported. Large appropriations of public funds enable these institutions to hold tuition at a much lower level than can private institutions. This study indicates that tuition and fee charges should be watched very closely. This study also illustrates that maintaining parity of these charges with other private schools within an institution's own area is not as important as typically would be thought. In recent years student charges at private schools have been increasing much more dramatically than those at state supported institutions. This widening gap in tuition and fees could indicate potential problems for private institutions, particularly during a time when there is a shortage of freshman applicants.

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Managing a Small Business College with the aid of a Computer Based Management Information System

by

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San Jose, CA

The purpose of this paper is to stimulate administrators to become more familiar with the advances in the information technology, to examine their information needs, and to use the new technology to enhance the functioning of their organizations, where feasible.

The paper focuses on the information needs of a graduate Business College, then discusses a microcomputer system, which address those needs, and finally, discusses the factors to be considered when looking for a solution to management information needs.

I. INTRODUCTION

Today, the data processing industry is marketing computer systems at prices that are merely a fraction of the prices of equivalent systems sold a few years ago. The systems referred to, are the minicomputers and microcomputers. The purchase of these systems is not restricted to business organizations but is fast becoming a routine activity of educational organizations and of individual purchasers. For example, in October 1982 it was announced that IBM and Carnegie-Mellon formed a joint venture to develop a prototype network to eventually link each student and faculty member to Carnegie-Mellon computers. The network will consist of some 7500 to 8000 powerful work stations that will be located in campus laboratories, classrooms, dormitories, off-campus homes and communication via the network and access to library information and other data.[1]

In addition to these relatively inexpensive and powerful computers, there is a fast growing retail software business that develops and markets software application packages that are directed towards an end user who has little or no experience in the art of programming.

The understanding of the capabilities and cost of these small computers and supporting application programs, should be of interest to all administrators whose responsibility it is to develop efficient management information systems. Combining this understanding with an analysis of the information needs of the organization can lead to the development of an effective microcomputer system.

II. A Management Information System for a Graduate Business College

A. Establishing the Information Needs of the Administration.

The initial step in establishing information needs is to clearly define the goals and responsibilities of the administration.

Following is a list of some of the goals and responsibilities:

1. Provide students with strong academic training and those tools which equip them for successful careers in the business world.
2. Ensure that the students welfare is protected and to offer aid where possible.
3. Manage faculty to achieve and sustain a high level of motivation. This involves matters such as salary, tenure, teaching facilities, growth opportunities.
4. Develop a curriculum and teaching programs that satisfy the needs of the students, the business world, and meets accreditation requirements.
5. Achieve in an efficient manner the following:
    a. Registration of students
    b. Scheduling of classes
    c. Assignment of classrooms
    d. Scheduling and assignment of faculty
    e. Maintenance and improvement of the physical plant
    f. Maintaining a superior library facility
6. Develop dynamic recruiting programs that will attract high quality students and faculty.
7. Maintain admissions policy which meets the requirements of accreditation.

8. Develop a sound public relations program designed to sell the school to prospective students, faculty, business corporations, and the ruling body of the college.
9. Manage and control the budget.
10. Construct future plans for continued growth of the college.
11. Develop successful fund raising programs.
12. Solicit corporate and governments granting of scholarship aid, internship programs, research grants and outright gifts.
13. Successful career placement of graduating students.

This indeed is an impressive list of goals and responsibilities. To successfully achieve them, the administration must have adequate and well trained staff, and reliable information. The required information may be presented in reports classified in several ways, namely -

a. Occasional reports (on demand)
b. Regular reports (fixed frequency)
c. Unit reports (by students, by faculty member)
d. Summary reports (by groups)

Following are examples of a set of reports which the college administration may use in the performance of its duties.

- Entrance scores of enrolling students. Figure 1.
- Academic standing of the student body. Figure 2.
- Student Financial Aid. Figure 3.
- Summary reports on recruiting programs. Figure 4.
- Summary reports on applications, admissions and enrollments. Figure 5.
- Monthly budget reports which compare the actual expenditures against planned expenditures. Figure 6.
- Report on funds raised and pledged. Figure 7.
- Placement report. Figure 8.
- Student profile report which provides pertinent academic information about the student.
- Faculty profile report.
- Trends and forecast projection reports based on present and historical data.

XYZ COLLEGE - ENTRANCE SCORES

YEAR xxxx SEMESTER x

NO. OF STUDENTS ENROLLING xxx

		SCORE	
STUDENT NAME	SUBJ. 1	SUBJ. 2	SUBJ. 3
XXXX XXXXXX	XXX	XXX	XXX

Figure 2 - GMAT ENTRANCE SCORES - Enrolling Students

XYZ COLLEGE - STUDENT STANDING

YEAR xxxx SEMESTER x

NO. OF STUDENTS ENROLLED xxx

GRADE POINT AVERAGE x.x

NO. OF STUDENTS BELOW GRADE POINT 3.0 xx

GRADE POINT BY AREA OF CONCENTRATION:

FINANCE x.x

Figure 3 - Academic Standing of the Students

```
                XYZ COLLEGE - FINANCIAL AID

YEAR  xxxx      SEMESTER   xx


                GRADE     AMOUNT THIS                PREVIOUS

STUDENT NAME    POINT       SEMESTER    SCHOLARSHIP  AMOUNTS

xxxxx xxxxx      x.x       $ xxx.xx       xxxxxx     $xxxx.xx
```

Figure 4 - Student Financial Aid

```
                XYZ COLLEGE - RECRUITING REPORT

YEAR  xxxx       SEMESTER   xx


COLLEGE                 STUDENT    GRADE

 NAME      ADDRESS      NAME       POINT    INTERVIEWER  PROSPECT

xxxxxx     xx xxxxx     xxx xxxx   xxx      x. x. xxxxx  xxxx
```

Figure 5 - Applications, Admissions and Enrollments

XYZ COLLEGE - APPLICATIONS, ADMISSIONS, ENROLLMENTS

YEAR xxxx SEMESTER xx

				DATES	
STUDENT NAME	COLLEGE	DEGREE	APPL.	ACC.	ENROLLED
X. X. XXXXXX	XXXXX	XX	xx/xx/xx	NA*	NE*

* NA = Not Accepted

* NE = Not Enrolled

Figure 6 - Applications, Admissions and Enrollments

```
                    XYZ COLLEGE - BUDGET REPORT

         MONTH  xxxx    1982 SPREAD REPORT


EXPENSE CODE   DESCRIPTION   JAN     FEB     MAR     APR     MAY     JUN

  XXXXX        XXXX XXXXXX    xx.x   xx.x    xx.x    xx.x    xx.x    xx.x


Total Budget                 xxx.x   xx.x    xx.x    xx.x    xx.x    xx.x

Total Budget (Planned)       xxx.x   xx.x    xx.x    xx.x    xx.x    xxx.x
```

Figure 7 - Budget Report

```
                   XYZ COLLEGE - PLACEMENT REPORT

         YEAR xxxx SEMESTER  xx


DONOR        ADDRESS              $ AMOUNT         PURPOSE


x. x. xxxxx  xxx xxxxxx xx          xxx.xx         xxxxxxxxxxx
```

Figure 8 - Fund Raising Report

XYZ COLLEGE - PLACEMENT REPORT

YEAR xxxx SEMESTER xx

STUDENT NAME	AREA OF CONCENTRATION	GRADE POINT	COMPANY	STARTING POSITION
xxx xxxxxx	xxxxxxxxx	xxx	xxxxxxxx	xxxxxxx

Figure 9 - Placement Report

B. A Microcomputer System for the College

The reports discussed above can be prepared using a microcomputer system. There are many available program packages which contain the functions that are capable of producing these reports. Two of these are the VisiCalc^{R} and dBASE II^{TM} programs.

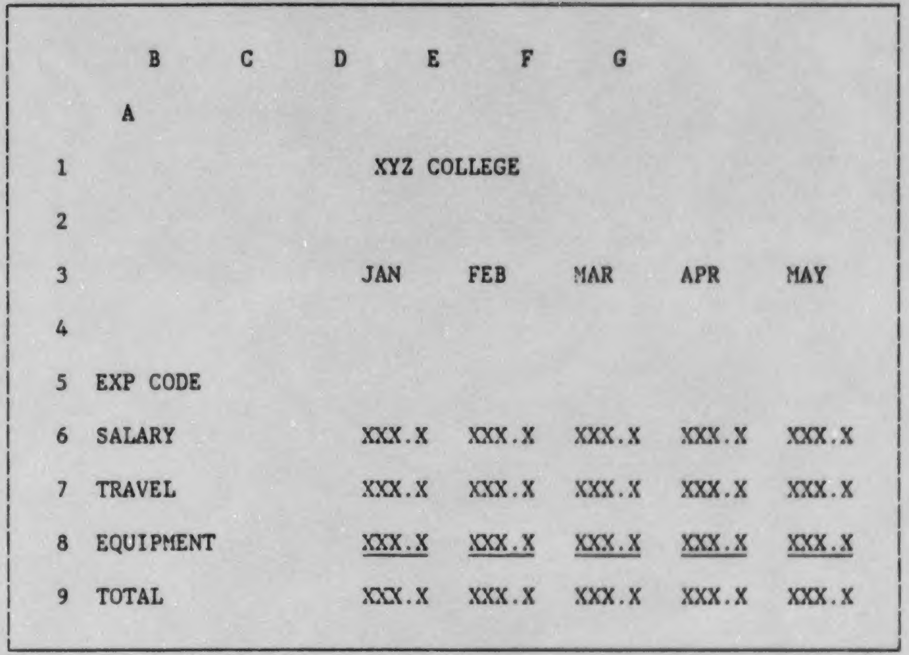
The VisiCalc program offers the end-user the following capabilities, namely:

1) Computing
2) Saving Information (Memory)
3) Displaying Information

The VisiCalc program causes an electronic worksheet to be constructed which is organized as a grid of columns and rows, and part of which is displayed on the computer screen. (See Figure 10.) The worksheet will be saved or printed as required.[2]

VisiCalc^{R} is a registered trademark of VisiCorp

dBASE II^{TM} is a registered trademark of Ashton-Tate



```
          B      C      D      E      F      G

        A

1                    XYZ COLLEGE

2

3                   JAN      FEB      MAR      APR      MAY

4

5   EXP CODE

6   SALARY          XXX.X    XXX.X    XXX.X    XXX.X    XXX.X

7   TRAVEL          XXX.X    XXX.X    XXX.X    XXX.X    XXX.X

8   EQUIPMENT       XXX.X    XXX.X    XXX.X    XXX.X    XXX.X

9   TOTAL           XXX.X    XXX.X    XXX.X    XXX.X    XXX.X
```

Figure 10. SCREEN SHOWING WORKSHEET

This program also allows the end-user to write formulas that consist of numbers, arithmetic operators, functions and references to other locations. It can calculate minimums, maximums, sums, averages and several other calculations. It permits the user to set up charts, tables, records and commands for formatting reports.

VisiCalc allows recalculations and thus permits the user to look at alternative solutions, and play "what if" games.

The hardware system required to run the VisiCalc program consists of the following:

- A Microcomputer (such as the IBM[R] Personal Computer)
- At least one diskette
- At least 64K memory
- Display monitor that will display 40 to 80 columns
- A matrix printer
- The VisiCalc program diskette
- At least one blank diskette

IBM[R] is a registered trademark of the IBM Corporation

The Budget Control and Financial Planning applications are excellent applications for VisiCalc.

The dBASE II program permits the end-user to create and manipulate small and medium size data bases by the use of simple English-like commands. Following is a list of features of dBASE II:

- Create a data base
- Add, delete data to and from the data base
- Display and edit the data on the screen and print it out
- Perform arithmetic and logical operations on data in the data base
- Product reports from one or more data bases
- Use the full screen editor to construct report formats on the screen and store them
- Use the dBASE II commands to construct entire applications programs. See figure 11.[3]

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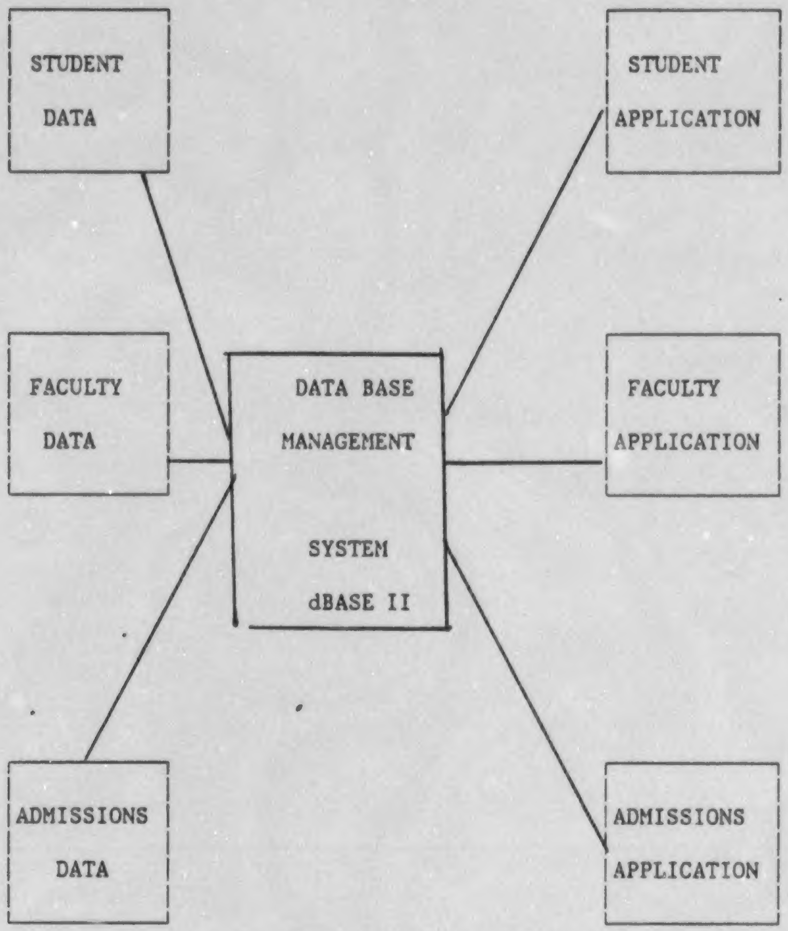
STUDENT DATA
FACULTY DATA
ADMISSIONS DATA
DATA BASE MANAGEMENT SYSTEM dBASE II
STUDENT APPLICATION
FACULTY APPLICATION
ADMISSIONS APPLICATION

Figure 11 - Relationship of the dBASE II program to data and Application Programs

The hardware and software requirements for running dBASE II are:

- 8080, 8085 or Z-80 base microprocessor system (like the IBM PC, Apple II TM with Z-80 card, etc.)

- 48K bytes minimum or memory for most micros. CP/M^{R} (Version 1.4 or 2.X) PC DOS^{R} operating system

- One or more mass storage devices (usually floppy disk drives)

- A cursor addressable CRT if full screen operations are to be used

dBASE II is capable of handling all of the applications mentioned above. It is a relational data base management system in which data is represented as it is, and a data element is identified by its position in a 2 dimensional table. See figure 12.

COL. 1	COL. 2	COL. 3	COL. 4	COL. 5
STUDENT NAME	STREET ADDRESS	CITY	UNDERGRAD DEGREE	GRADE POINT
JOE BLOW	31 XYZ	COPUM	BS	3.6
DENNIS FINK	800 LAMAR	LAXAT	AB	3.2
MARGE LEWIS	9016 SETAL	MATAN	AB	3.9

FIGURE 12

Apple II^{TM} is a registered trademark of the Apple Computer, Inc.

CP/M^{R} is a registered trademark of Digital Research, Inc.

PC DOS^{R} is a registered trademark of IBM Corporation

C. FACTORS TO BE CONSIDERED

The selection of an information management system for any organization is not a simple matter. In this paper, a microcomputer solution was suggested for a college administration. However, a microcomputer solution is not necessarily the only viable system solution that should be considered. Other solutions include the following:

Manual processing
Timesharing
Distributed system

A decision as to which system solution is best for a particular organization would depend on many factors. Some of these would include:

- Available resources (dollars)
- Personnel levels
- Accessibility to other computing systems
- Volume of information processed
- Frequency of information reporting
- Characteristics of available computing equipment

When considering the microcomputer as a possible solution, the following characteristics should be evaluated.

- Microcomputers are relatively inexpensive. The purchase price for a microcomputer system with the VisiCalc and dBASE II programs should be within the range of $4000 to $7000.
- Program applications are generally easy to install on microcomputers.
- Many available program packages are so constructed that the users of those packages are not required to be full-time programmers.
- Unlike Timesharing system terminals, microcomputers do not depend on a central computer for the processing capabilities.
- Microcomputers may not be the answer to an organization that requires several computing jobs to be performed concurrently.
- They also may not be the answer to organizations with heavy requirements for voluminous reports.

III. The Future

As the software business grows, an increasing number of application packages will become available. Examples of these include new graphics programs and business forms processors.[4] Indeed, college administrators should be aware of these software developments and acquire those which will enhance their operations.

As the administration becomes more familiar with the microcomputer system, consideration may be given to adding additional microcomputer to various departments in the organization. These microcomputers may be tied together in a network using a network system. An example of a network system is one called PCnet.™

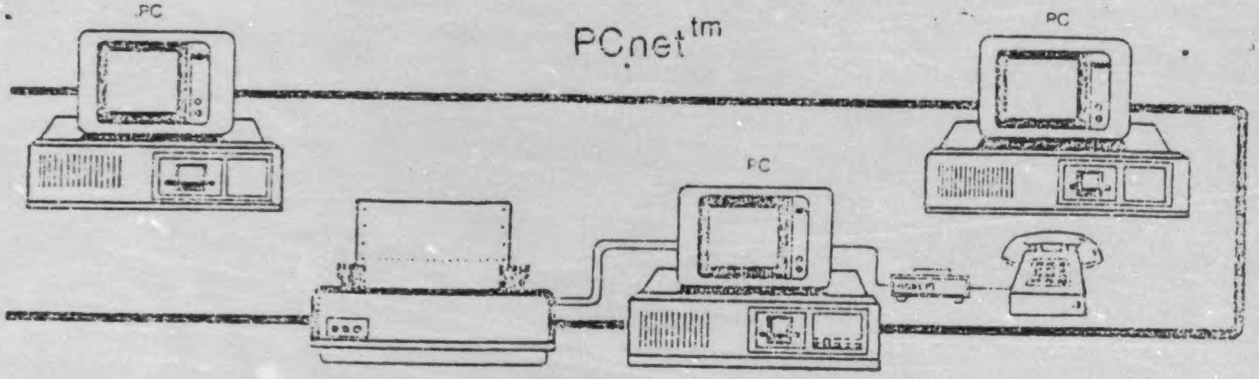

Figure 13 - diagram of PCnet reproduced from brochure (described in reference 5)

PCnet is a network designed to interconnect microcomputers via a high speed local network. Such a network allows expensive resources such as hard disk units and letter quality printers to be shared, thus reducing the per station cost. A network permits sharing of files, programs, etc., among several cooperating users. Network increases the range of applications that can be handled by inexpensive microcomputers.[5]

In conclusion, a variety of good equipment is available. The cost of this state-of-the-art equipment is no longer prohibitive. Programming support makes the equipment easily adaptable to various needs. In view of this, administrators must evaluate their needs and match them with the capability of existing systems in order to improve the college operations and reduce costs.

PCnet TM is a Registered trademark of Orchid Technology

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WHAT IS WRONG WITH SYSTEMS ANALYSIS

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Systems Analysis is frequently compared to other disciplines that require advanced planning. Software need not be so permanent as a building or computer chip. As we gain experience with old tools and reach the limit of their productivity, we tend to develop new tools with new levels of productivity. In turn, the tools we use tend to change the way we think. To improve applications development productivity we need new and better tools.

Marist has had experience getting the results of Systems Analysis without using that set of tools. Marist developed 21 subsystems in 18 months which ended up well structured and compatible. It was possible because an unusual consultant was hired to help us. It was his style of almost immediate code generation combined with the highly productive APL language that helped insure a very successful effort. Contrary to conventional wisdom, we have been shown how to develop major systems without the typical systems development life cycle approach.

What is wrong with Systems Analysis

Systems Analysis is frequently compared to the work of an architect. Before building a house, considerable effort is made to specify the design in great detail. Some believe that the transition to true software engineering is to be measured by the degree to which we move the software development effort into the analysis and design stages.[1]

In the case of a house, once the foundation has been poured, a substantial committment has been made to the end result. In the case of computer hardware, once the integrated circuits have been placed in production a significant milestone has been passed. And for much of the history of software development, once the first thousand lines of code were written, significant investments had been made and eventual outcomes determined. But computer programs need not be cast like foundations nor manufactured like chips. That's why we call them "software".

Learning to use new tools and techniques is not smooth. A study of experience curves[2] clearly shows that when we develop experience in a new idea or technology we tend to build exponentially on prior experience. It also shows that as progress reaches some learning or productivity limit, we tend to develop new skills at higher levels of productivity. This is how our technology advances.

Furthermore, as can be demonstrated throughout history, it is very difficult for those who are active in using a new tool of society to objectively see the way the tool itself changes our way of thinking. Tribal societies tend to maintain their tribal structures until they learn to read. "After reading catches on, the tribe often dissolves, the readers drifting off to towns to work in factories. Reading instills a basic acceptence of sequentiality."[3] What may well be the problem of systems analysis is its growth out of sequential reading through the early days of sequential tape based computer systems. Today, data base systems are non-sequential in many respects. Early products of systems analysis tended to be oriented toward records, files, pages, tables. Until a new tool evolves that breaks this reading influenced sequential mind set, systems analysis as we know it will prevail as a powerful tool to discipline our structures to conform.

"For DP-developed applications a productivity of application development is needed many times higher than today. This will not be achieved with sturctured programming or today's structured analysis."[4] We are reaching the limit of what today's methodologies can do at a time of great need. The number of applications in today's data processing centers is growing at the rate of 45% per year. It suggests that with current methodologies the need for programmers will grow from about 300,000 today to 28 million in ten years. At this rate all Americans will be working as programmers before long.[5]

The problem of finding applications programmers who are capable of developing new systems and responding to the rapid expansion of demand for computing support is difficult. For the small college it may be more a matter of luck than anything else. It most certainly is the case for small colleges a development team with systems analysts, programmers, and user services will be the exception. If your experience is like most other small colleges you are finding it difficult to attract any experienced and well qualified staff as teachers or programmers. In our area, a graduating computer science major draws a beginning salary about 20% greater than the highest paid Marist programmer. So even though Marist's experience can not be attributed to a well thought out master plan it none the less has something to say about systems development.

Marist College, starting with two inexperienced applications programmers developed a campus wide operational system on its IBM 4341 in 18 months. This included automation of several areas that had never used the computer, several who were using 1401 oriented batch systems written in Autocoder and several who were using code developed by a local time sharing service. The completed system is highly structured, on-line, interactive with every production component capable of being run automatically in a defered run time mode during second or third shift. The system places data responsibility and control in the hands of the user offices and requires only one-half full time equivalent computer operator to support production needs. The automated areas include Payroll, General Ledger, Accounts Payable, Budget Preparation, Student Accounts Receivable, Admissions Office Inquiry System, Admissions Tracking System with an Office System 6 interface, Continuing Education student records input, Special Academic Programs student records input, Student records, Master course history system, specific course system, student registration system, grades management system, transcript system, Student housing management system, Alumni Records system, Development system, Campus Security system, Library circulation system and a generalized report generator.

It is my firm belief that had we purchased a comprehensive package to provide all of these operational systems that they would yet today, 30 months later not all implemented. It is an unchallengable fact that had we used the current state of the art tools and approached this task with structured systems analysis and design, we would not yet have completed the system. Having written applications myself for over seven years before this project, I must confess I was surprised as each new system went on-line. Since I teach about the tools of structured systems analysis and design as advocated by the Yourden Group [6,7] I have been most curious as to how the desired results of structured analysis and design can be achieved without the methodology. I feel that some of the details of our experience can help me support my conclusions.

Before we began our development effort, Marist employed an external consulting firm to advise us on how to solve our software backlog needs. Their recommendation produced a minor crisis at Marist in the Computing Center. They recommended the purchase of a software package written in COBOL to run on our 4341 that would address the areas of Payroll, General Ledger, Accounts Payable and budget preparation. The projected implementation schedule was one year. The cost was in the order of $150,000. The major reason for the panic in the Computer Center was based on two facts, 1) COBOL was not a language on our computer, and 2) No member of the staff had ever programmed in COBOL.

The Marist professional team had joined Marist from Shared

Educational Computer Systems, Inc., a company providing APL time sharing services of which Marist had been a user. The thought of being restricted to a COBOL instruction set to implement ideas into code was abhorent. We were all convinced that APL was superior and now we were being directly challenged. However, even APL had not solved the outstanding backlog problem. But the seed had been planted for buying software and a frantic search by the center began for the needed systems written in APL

The search led to an unusual software contractor who wrote code only in APL and worked only on fixed price quotations[8]. Furthermore, his quotations were generally developed after only an hour or two with the end user. He claimed that he could install our Payroll system in less than 30 days. After researching his clients and becoming satisfied he had produced as promised for each of them, we invited him to quote on the Payroll, General Ledger, and Accounts Payable system. The quotation was so reasonable by comparison COBOL route, Marist, holding its breath, decided to make the plunge. As promised, the Payroll package, begun after the Thanksgiving holidays, was running by the first of the year. The General Ledger and Accounts Payable followed in another 30 days. With this success story, the other systems were tackled and at the end of 18 months all administative offices that could justify it were automated.

During this 18 month period, the software consultant worked closely with the Marist staff to train our programmers. Marist had recently employed two new, inexperienced programmers. In addition to the developed software, he trained these two staff who now provide the major portion of the software enhancements, new subsystems and minor maintenance chores.

While I was supervising and assisting in this development project, I was teaching structured systems analysis and development. It was constantly on my mind how the project could be so structured, so well designed, so clean without using any of the tools. On several occasions I asked the consultant how he learned to develop structured systems. He was not even aware of the tools or termonology of systems analysis although he said that many people had asked him that question.

Finally, I was able to discern a number of factors that led to his successful style and using them have been able to develop systems quickly, and without the long lead time required by systems analysis. Unfortunately, the solution is sometimes too hard to swallow for someone who has been in the data processing business for several years. Even in this rapidly changing field, there are many of us who are hesitant to change.

I am only interested in dealing with what I feel are a couple of the most significant aspects of the development process now used at Marist. I want to lend support to what I can now find supported in the literature.

First of all, we do not spend much time talking about a system before we write some code and get it into the hands of the user! There is a tremendous temptation for programmers to write too much code. Given sufficient lead time, any programmer can design a very complex solution to a very simple problem. Getting code into the end user's hands as soon as possible helps the user keep the programmer focused on what is important - correct results. Left to their own devices, we programmers can spend enormous amounts of energy on the esthetic beauty of the finished printout. If a system is to be useful, beauty may not be an important factor. In any event, the form of the result is easy to improve long after the contents are known to produce correct results. And, in the mean time the focus and energy is on the significant result - accurate information.

As Martin[9] points out, there is an uncertainty principle with data processing as well as physics. The act of providing what a user says he needs changes his perception of those needs.

Another important key is measured by lines of code. The cost of system maintenance will be proportional (maybe exponentially proportional) to the number of lines of code required to run it. It is tempting to develop systems that handle 99.9% of the possible cases. But the 80-20 rule applies. The last 20% of the cases you try to handle will require 80% of the code and 80% of the modification requests. The value of a system over time is not that it models the world today at the 99% level, but that it will model the world tomorrow at better than the 50% level, better than chance. The Marist programmers are savey to the greater long-term value to be stingy with code but high on quality; to pay close attention to consistent style and standard implementation conventions; to value simplicity of file structures and programs over speed of execution. Reducing lines of code is so important to us that we pay the user to retire little used menu items.

But the real power of our process falls in two areas. First, the use of a high level language, APL for all administrative systems. Adrian Smith gives the following reasons for using APL.[10]

- Will get results in days rather than weeks
- Query language is easy to build and quick to modify
- Faster, more concise, and more flexible than conventional languages
- Gets the bugs out of the design at very little cost
- May be the only way to get something off the ground fast enough

The second source of power relates to getting the user to the computer at the earliest possible stage. There are really three parties to a development; the end user, the analyst/programmer, and the computer.[11] The best way to get all three together in the end is to get them together in the beginning. Every system should begin as soon as possible as a prototype. As the prototype evolves, because of the user's experience with the developing tool, it may become his finished system. But, if the prototype goes sour, who cares? Just start over with a new model.

The current efforts at Marist are carrying the development process another step forward. We have almost completed an Applications Generator that will allow our Marist offices to develop their own subsystems with assistance from non-analyst/programmer type staff. The products they generate will be automatically documented and totally compatible with other campus software systems. Although its not ready for release, the word is out and seven subsystems are already up and running.

Systems Analysis will be around for some time. Now that all our systems are installed, we have found it quite useful to have users request enhancements requiring more than a couple of hours work to do so in writing. We then write up some loosly defined specifications and give a fixed price quotation. But many requests take less than two hours because the system is well structured and highly consistent. Because of our success at this level, we plan to actively pursue systems that will allow users to install systems themselves. In addition to our own Application Generator, we will be providing tools like ADRS, QBE and other end user tools, especially those that operate in the highly productive APL environment.

What's wrong with Systems Analysis? Its out of date for many of today's needs, especially in small systems. The results of Systems Analysis can be achieved without the tool. We know, we've experienced it! But, its hard to do alone. The best way is to be shown by someone who already knows how - like the consultant Marist used to change our methods.

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SYSTEMS PROTOTYPING WITH FOURTH GENERATION TOOLS

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Traditional systems development is extremely time consuming because analysts must spend much time to accurately define users needs. End users have difficulty visualizing the needed system in the abstract and, after implementation, often revise their perceptions of what is needed. Requests for changes or enhancements produce frustration for both the user and the programmer. The development of information systems using an engineering approach which utilizes both traditional programming techniques and fourth generation software tools is described in this paper. Fourth generation applications tools are used to quickly develop a prototype system which is revised and expanded as the user clarifies his/her requirements. When fully defined, a combination of cost-effective techniques is used to develop the final system. The report concludes by discussing the development of a system at a private college which used this approach.

Overview

College administrators, like their business counterparts, are becoming increasingly aware of the need for improved information as a basis for planning and effective management. Department and office heads are also starting to realize that the availability of timely and accurate data can make daily responsibilities easier to accomplish. As a result there is increasing demand for new computer applications throughout our institutions at a time when the higher education environment is one of declining resources and overall instability. In this setting, there is a limited supply of resources which can be committed to the development of new systems.

A basic challenge facing campus computer centers is one of supply and demand: the demand for information systems far outstrips the supply of personnel available to develop the systems. Significant programming backlogs are a way of life at most centers. New software tools with the potential to improve systems development productivity are available but utilization is not widespread.

This paper describes an approach which avoids the major limitations of the fourth generation tools and builds upon their strengths. When combined with other techniques, these tools can be used to develop systems which provide greater user satisfaction than those developed with conventional methods and which require less development time.

Background

The "third generation" in the evolution of data processing introduced of a number of technologies and methodologies aimed at increasing programmer effectiveness and productivity: on-line programming, data base management systems, data dictionaries, structured programming, information retrieval systems, among others. These made a positive impact, yet the backlog of programming requests continues. A number of factors contribute to this situation. One such factor is the increased administrative awareness of the need for decision support systems and *ad hoc* reporting which in turn leads to increased requests for software to meet these needs. Another factor is that each successfully completed project allows users to discover additional reports or functions that would make their jobs still easier. Requests escalate as user sophistication increases. Yet another factor contributing to the backlog is systems which do not satisfactorily meet the user's data and information needs. These result in requests for changes almost as the applications are being installed. (In many shops, maintenance requests occupy 60-80% of programmer time.) All of these factors contribute to the applications backlog and support the need for far greater improvements in the system development process than has been achieved to date.

A number of fourth generation software tools have been introduced to this environment. Included in this general category are such products as relational data base management systems, interactive applications development systems, and integrated enhancements to third generation products. Developers claim that the new systems have the potential to dramatically improve productivity. Much discussed and still controversial, their acceptance and utilization remain uneven. While some of these tools have been heralded as a means whereby end users can develop their own applications without professional programmers, this may not be the most effective utilization of either the technology or the personnel involved. Do we really want our Business Managers, Registrars, Deans, and other administrators to develop applications with little support from a data processing department? Few end users have the time or desire to develop their own applications, despite claims the products are "user friendly". From an institutional perspective, "productivity" is total useful output compared to the resources employed. In systems development the measure of resources must include not only hardware and computer center personnel, but management and user time spent in developing the application. If end users develop their own systems, it could reduce the backlog of applications requests in the computer center at the cost of reduced user productivity in performing assigned institutional functions.

On the other hand, professional programmers resist using these new tools because 1) they are more comfortable with traditional languages and established methodologies, 2) "user friendliness" often vanishes when complex data handling is required, 3) present fourth generation applications tools cannot create every type of application that conventional programming can, and 4) complex systems developed with fourth generation software tools typically require a heavy commitment of computer resources and may be much slower to execute than comparable systems developed with conventional methods.

Most technological improvements - third and fourth generation - have been aimed at decreasing the time spent on actual programming of applications. Little has been proposed that can speed up the initial analysis process. We all know that thorough analysis is essential to accurately define users needs and insure that the finished application is effective. However, there is a basic communication problem between users and programmers. Users do not understand technical terms or systems charts and programmers do not understand the details of the users' operations. Thus traditional systems analysis is extremely time consuming, exceeding the time required to program an application. Despite the time devoted by analysts in defining specifications, end users have difficulty visualizing the needed system in the abstract and, after implementation, often revise their perceptions of what is needed. Requests for changes or enhancements produce frustration for both the user and the programmer.

In a typical application developed with conventional techniques, the greatest number and most significant problems occur in the requirements specification and design stages. The expenditure of considerable time and much frustration accompany this process because both participants - user and analyst - are dealing with abstractions. What is urgently needed is a way of moving quickly from the abstract to the tangible.

An Engineering Approach

At this point, it is of value to briefly review the established procedures for development of new products in other fields. Few manufacturers would long survive if they used the same development process used in our computer centers, i.e., refine the product specifications on paper and go directly into production. In contrast, industry uses an engineering approach. After a proposed product is identified and specifications developed, a prototype is created. The prototype is used to test the design, insure that it performs the desired functions, and obtain the feedback needed to identify and make any desired adjustments before a final product is developed. A clear understanding of how it will be used also guides selection of the most cost-effective techniques for building the product.

Paul Hessinger, Director of Reseach at Computer Task Group, Inc., suggested the concept of prototyping software applications as a means of decreasing development time. At a recent seminar on productivity, he recommended a three-step engineering approach in which identification and definition of the "product to be built" is the first step. Second, a prototype is developed, using fourth generation tools to quickly establish a basic system. This leads to a clear understanding by users of how the system works, what information is available, and enables users to identify any essential changes or additions. Third, the most cost effective techniques are selected for building the final product.

With the availability of fourth generation software tools, development of a system prototype is feasible in terms of time and cost. Use of a prototype to test specifications should increase productivity by insuring that the system wanted by the user is the one that is developed by the programmer. Reprogramming and delays during the implementation stage are prevented.

Based upon experience, this report recommends a further modification of the prototyping technique. Prototyping has the potential to dramatically increase productivity and effectiveness of the systems analysis process itself. It can and should be used by the analyst as a tool to initially develop system specifications, rather than to test specifications produced by traditional analysis. With this approach, steps one and two above become merged into one iterative process: preliminary analysis is brief and aimed at identifying the basic tasks upon which a rough cut prototype is put up by the analyst and presented to the user as a simple, preliminary version. The fear of making a mistake or overlooking a vital element no longer haunts analyst or user since there is little need to define the ultimate system at the outset. At this point, the system is no longer an abstraction; the user can enter data and play with the system as a means of testing its capabilities. This establishes a clear understanding by users of how the system works and what information is available. Analysis continues, using the adaptable prototype to guarantee that user and analyst are talking about the same thing. As specifications are developed, they are incorporated into the model.

After the user is satisfied that specifications have been adequately defined, the next step is to select the most cost-effective techniques for creating the final product. At this stage, various options need to be carefully and pragmatically evaluated. If the application will be used infrequently or the running time is adequate, it may be most cost-effective to use the prototype without further development. If running or response times are a problem with the prototype, there are two general options to explore: the first is to analyze the application, identify the problem areas and reprogram only the problem segments in a traditional language. In other cases - high volume, multi-user applications for example - the prototype will serve as the blueprint from which the final system is programmed. The nature of the application is also a major consideration when selecting programming techniques. For example, decision support systems with their inherent need for flexibility and ad hoc reporting are most effectively handled with data management information retrieval software such as INFO from HENCO, Inc. or DATATRIEVE from Digital Equipment Corportion. In these cases, a refined prototype may be the ultimate system. On the other hand, standard operational applications which are subject to little change and heavy use are candidates for more traditional languages augmented by application generators.

Case Study

An opportunity to apply prototyping occurred recently at Canisius College, a small, private institution in New York State.

A personnel system had been scheduled for development as one part of an integrated, on-line administrative system. When time and resource constraints put the personnel component on "hold" only a few general system requirements had been articulated. Detailed analysis and design were yet to be accomplished.

The Director of Planning and Research had some systems analyst background and a strong motivation to acquire a personnel system since the Planning Office is responsible for all off-campus reporting, including personnel data. After discussing the project with the Computer Center data base administrator, a decision was made to build a prototype which, if successful, could serve as a model for the official system.

Project materials assembled during the initial planning stages were reviewed by the Director of Planning and Research, who also held several meetings with the Personnel officer, and one meeting with the Academic Vice President to review system needs. Planning office needs were then integrated with those described by the two major users and a prototype system was established by the Director, using INFO.

The first version had only a few input screens, but they were adequate to begin loading demographic, academic, and salary data. During the process of refining system requirements, various data elements were added, deleted, or modified; coding tables were developed and basic reports identified. Because of the relational nature of INFO and the ease of file modification, changes were implemented readily. The definition process was completed after several additional meetings with the users and the prototype is currently in use at the institution.

Two senior computer science students are now completing a reprogramming of the system to meet the standards used for other College administrative systems. This structured process includes development of all basic systems in COBOL aided by use of the RIMS generator (a product of Information and Systems Research, Inc.). All screens are developed with a screen generator written in-house, and reports are produced with DATATRIEVE. This programming standardization produces quality software for multi-user applications in a relatively short time. Additional benefits of the reprogramming will be improved response time and an additional level of security for confidential files.

Conclusions

Several observations made during the development process are pertinent to the issue of productivity:

- Less time was expended in the development process than would be required with traditional methods. The Director performed the analysis and prototyping in addition to regular institutional duties. Although the process extended over a three month period, total time devoted to systems development was minimal.
- Announcing the project as development of a simple prototype removed the personnel officer's fear of making a mistake and overcame the initial hesitancy in defining system requirements.

- The prototype served as a catalyst, increasing useful dialog between analyst and user, which led to rapid system definition.
- The prototyping technique is particularly useful when working with users who have little or no experience with computer applications. Novice users quickly respond to the tangible "working model".
- Initial concerns that secretarial staff would be confused by working with a changing system, proved unfounded. All modifications were immediately added to a users' guide and staff needed only minimal supervision to adapt to changes.

The increased productivity to be derived from using fourth generation tools is a strong motivation for changing the conventional programming process. Even more significant however, is the potential to accelerate the analysis process and eliminate many of the problems and frustrations encountered with conventional development efforts. The appropriate tools are available now. The challenge is to convince programming staff to use them.

Based upon the experience at Canisius College, the author concludes that the engineering approach to systems development has the potential to significantly increase productivity beyond that achieved with conventional methods. As one of the few approaches to streamlining the analysis and design process, prototyping deserves broader application and further refinement.

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THE ORGANIZATIONAL IMPACT OF A DECISION SUPPORT SYSTEM

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In this paper, the authors conduct a follow-up evaluation of a decision support system which was installed five years ago. The original system was a DSS for small college admissions. The present paper describes changes in the system, changes in procedures brought about by the system, and changes in the organization which may have been encouraged by the implementation of the system.

THE ORGANIZATIONAL IMPACT OF A DECISION SUPPORT SYSTEM

Introduction

Approximately five years ago, Guilford College, a small private liberal arts college in Greensboro, N.C. installed a decision support system for forecasting and simulating enrollment. The design and implementation on that system was described by the present authors at the CAUSE '81 National Conference [1], and later was published in a special DSS edition of CAUSE/EFFECT [2]. This year, the authors decided to return to North Carolina to see how the system had evolved and changed over the past five years. In this paper, we shall present a brief summary of the system as it was originally installed, describe several ways in which the system has changed, and outline ways in which the system has caused the organization to change. We look at parts of the decision support system which were originally installed, but which have fallen into disuse or discarded entirely; we look at how the use of some parts of the system has changed over the years; we look at new parts which have been added to the system as the users saw opportunities to improve upon the ability of the system to support admissions decisions; we look at how the use of the system has caused changes in the procedures followed by the organization. Finally we look at fundamental changes in the attitudes and thinking in the organization which have been influenced by the use of the decision support system.

ORIGINAL MODEL

Throughout the 1970's and continuing in the 1980's, small private colleges have faced the dual but opposing problems of maintaining academic standards while keeping the colleges financially healthy. The problems can be described as opposing because maintaining academic standards generally implies restricting enrollments, while maintaining financial health generally implies expanding enrollments. Admissions officers have been the focal point of the effort to balance these two goals. Although others in the organization are obviously interested in the problems, they tend to focus on one or the other of the difficulties. The faculty and academic deans are interested primarily in academic standards (although lately they have become more aware of the financial implications of their academic goals), while the business offices and financial officers tend to do most of the day to day worrying over the money problems. And because both of these groups look to the admissions office to solve their problems, the Director of Admissions must find ways to satisfy both.

The situation at Guilford College was probably typical of this situation at many small private colleges. Enrollments were holding steady, but the admissions people were having to run harder and harder just to keep up. Some technological innovations such as the SEARCH system (a service generating individually tailored mailing lists) helped to generate more applications in the short run; but as more schools used the service, its effectiveness wore off and the schools had to maintain the expense of the service just to stay even. And, as many schools soon learned, generating more applications did not always result in increased admissions. Other factors had to be taken into account which may be broadly characterized as the firmness or seriousness of the application.

It was in this context that the original decision support system was designed and installed at Guilford College. Since the system has been described in detail previously, we shall not attempt to present the underlying rationale for the system here, but rather shall focus on the structure of the system and the effects of its use. The ultimate purpose of the system was to provide a real time system for generating enrollment forecasts at any point in the year long admissions process of recruiting and enrolling a new freshman class. It quickly became apparent, however, that the information required to generate such a forecast would require a major restructuring of the thought processes of the top management in admissions (and to a far lesser extent the operating people), and provide decision support far beyond just a single forecast. And, as is typical with the installation of almost any new decision support system, significant problems with the integrity of the admissions data base became apparent. The data base was maintained using the WISE system on a PDP 11/40.

The first instance of rethinking by top management was in the setting of the objectives for the admissions process. The admissions director and those at his level were used to thinking in terms of a single number as the enrollment goal, usually a single number representing total enrollment at the college. The DSS focused on the problem of the freshman class, so the top people were forced to deal with the fact that new admissions and returning students were two (and often more, e.g. transfers, readmits) separate groups requiring different strategies. In addition, the DSS made explicit the fact that any goal is simply an estimate, and treated it as an interval rather than a point estimate. This required the top managers to delineate intervals around that goal and assign probabilities to the intervals. Further, since the system needed a basis for comparing the progress of the admissions process during the year, they were forced to define what an ideal progression would be. And finally, it forced them to think of most of the parameters of the system in probabilistic terms rather than as fixed values.

The primary output of the system was the forecast. This was run every two weeks. Two weeks was chosen to fit Guilford's volume and method of operation, and could easily be changed on any system where the DSS is implemented. The forecast consisted of a category by category projection of freshman enrollment culminating in a point forecast, a measure of its variance, and a statement of the probabilities of the enrollment falling in various intervals. (See [1] or [2] for sample printouts.) The system has several other inputs and outputs, however, which are nearly as important as the forecast. The previous paragraph describes a number of items which the admissions managers were now forced to consider. All of them had to be entered into the data files for the DSS. Some were entered interactively by prompting the person initializing the system. Others were entered by an operator. Since the system had to reflect the dynamics of the admissions process, however, a number of inputs were required throughout the admissions year. The most important of these was the timely updating of the admissions data base. As in most computer based admissions record systems, each applicant was given a record which had room for personal data and a series of dates relevant to the admissions process. Part of the DSS was an interface program which extracted the data required by the DSS from the data base. If the data base was not kept current, or if it contained errors, the DSS output was out of date or in error. The interface program was run every two weeks as the first step in a forecast run. Next, a period by period (one period was two weeks) summary of the data had to be generated and stored. These summary data consisted of items such as the number of applications processed by period, the number of admits, the number of accepts, the number of withdrawals, and the resulting proportions and probabilities. Although the only step necessary to prepare for the forecast was to store these data in a file, they were output in tabular form to provide a running record of progress, and to provide a check point for errors in the data base. (A copy of this output is also in [1] and [2].)

The final primary input to the forecasting program was the number of admits and rejects for the current two week period. To give the admissions office a consistent basis for determining the criteria for accepting and rejecting applicants, a scoring system was developed. It considered seven characteristics of each applicant and not only incorporated the evaluator's judgment, but also any uncertainty the evaluator felt about that judgment. The system was devised so the evaluator could use the system interactively on line or could use a manual form and batch in the results. It was also designed to provide a reasonable consistency across evaluators. When all applicants had been evaluated, the DSS computed a score for each and displayed them in sequence for the evaluator to decide on admits and rejects. As the decisions were made, this information was entered into the primary data base for use in the next period. The display of the group of applicants being evaluated could be printed out and maintained to insure consistency across periods.

A final feature of the system which should be mentioned is the simulation feature. Any forecasting system may be used for simulation by altering the parameters to see how they will affect the forecast. The admissions DSS forecasting program was designed with that purpose in mind. Each printout contained a listing of the parameters that went into the forecast, and each run contained a routine which allowed the operator to experiment with different values of the parameters. The operator in this case would generally be someone with decision making authority in admissions, because different values of the parameters had implications for resource allocation. For example, two of the parameters were the application flow and the acceptance rate of admits. Resources could be shifted between the two, and the simulation could give guidelines as to the timing and quantity of the shift.

THE SYSTEM FIVE YEARS LATER

In this section, we shall describe changes in the system which have taken place over the last five years. We shall use the format presented in the introduction of looking at five aspects of the system: the parts of the system which have fallen into disuse, the parts of the system that have changed, new parts which have been added to the system, changes in procedures caused by the system, and changes in thinking caused by the system.

The primary part of the system which is no longer used is the scoring system for determining the quality ranking of the individual applicants. The reason it is no longer used is quite simple--it was a direct replacement for an existing system and was harder to use than the old system. The existing system was the NCAA standard table for predicting college performance using an applicant's SAT scores and high school rank. It was easy to use and the new system did not prove significantly better in predicting first year performance. This did not have a major impact on the DSS since it only required some method of determining who would be accepted and rejected and was not particular about the method for making the decision.

The second part which is used less than intended (although it is still being used) is the actual forecast. We found this to be somewhat surprising until the assistant director of admissions (who is in charge of day to day operations) made the comment that he did not need a forecast since he already knew from experience what the final number would be. We then realized that this was a typical situation in any organization. He did not want the forecast because part of his value to the organization was in knowing the final number, i.e. being able to make his own forecast by intuition. With the DSS being able to do the same thing for anyone who knew how to operate it, that skill would become expendable. Further questioning brought out the fact that he also had not trained anyone else in the office (other than the computer operator) to operate the system. He confided that he liked to use the simulation feature of the system to generate forecasts that would scare people. In other words, by controlling the flow of information to the decision makers, he could effectively control the decisions. Fortunately for the College, he was an alumnus and had only the best interests of the College in mind. Also fortunate was his exceptional skill at the job which led to good decisions.

In addition to the changing use of the forecast, one of the printouts which had been almost an afterthought became increasingly important; this is the printout described earlier which cross tabulated applicants by status and predictive index for each two week period. The program which generates the printout also generates the primary input for the forecasting progam. Although we had discovered previously that the printout was informative, its new relative importance surprised us. On reflection, however, it was not so surprising. The assistant director was using it as the primary input for making his intuitive forecasts. Just as it helps the DSS make good analytic forecasts, the printout helps the assistant director make good intuitive forecasts. He also discovered that by using the indexing capabilities of the WISE system, he could get selective printouts. The indexing capabilities allows applicants to be selected by any field in the admissions record. Thus he could run printouts for just in-state applicants, for example, or just female applicants, or just black applicants, and so on. As it turned out, he was quick to use this indexing capability when he extended the system.

Three new parts have been added to the original DSS. The first is a scheduling program which was designed or help the secretaries keep track of all the correspondence required for each applicant. With the systematizing of the process under the DSS, it became a fairly logical next step to generate a schedule every two weeks for the applicants being considered in that period. The scheduling program prints out a schedule for each applicant in that period for each letter the applicant is to receive. Rejects get reject letters, of course, but accepts receive a stream of letters from the basic acceptance letter to letters from their indicated major department to letters from extra curricular organizations in which they have an interest. All of these are timed to continually remind the applicant that the College really wants him or her with the purpose of turning an accept into a paid deposit. The present plans are to automate the letter writing capabilities. The College is installing DECWord, a multi-user word processor. Instead of printing out a schedule for each applicant's correspondence, the scheduling program will feed the schedule to DECWord which will print out the appropriate letter on schedule.

The second additional program generates an admissions profile. It generates three tables. Each classifies applicants by public or private high school, by in or out of state, and by freshman or transfer student. In addition the first table classifies by application status, the second by high school class quintile, and the third by SAT scores. Once again, the indexing capability of WISE may be utilized to generate the tables by any field in the admissions record.

The final program which has been added to the system also generates tables cross-classifying applicants. Known as the REGIONS program, it starts classifying applicants at the contact stage. It has eleven columns ranging from contacts through accept and reject through percent net paid. The rows in the table are the counties in North Carolina, the remaining states, and all foreign countries. This program originated indirectly from the simulation mode of the forecasting program. That mode allows the admissions director to trade-off resources between functions. If the director wants to put more effort into getting admits to enroll than in generating more applications, he or she must know where to direct the effort. The REGIONS program is a result of the need to know that information. It shows where the contacts are being made and how many of the contacts are turning into applications and later into actual students. The indexing feature of WISE is very effective here. One run we saw had been sorted according to all contacts who had responded to the SEARCH mailing (which was highly selective in terms of SAT scores), and all who had directly requested that Guilford receive their SAT scores. The list contained about 1300 highly desirable recruits. They all met the College's quality standards, and all had shown an interest. The printout showed where they were and how many there were. Another use we saw, but which the assistant director said he did not allow anyone else to see sorted the applicants by the admissions counselor who made the first contact. Thus, he could see who had made the contacts, and how effective they were in following them up. His future project is to be able to enter the cost of recruiting in each region to be able to see the unit cost of recruiting students from each region. The primary deterrent to implementing this change is the inability of the accounting system to generate costs broken down by region.

The changes in procedures brought about by experience with the DSS are, as one might expect, primarily in the dealings of the admissions people with the computer. One of the problems pointed out in the implementation of the DSS is that is data base integrity. The supposed primary data base was, in reality, used as a secondary data base after the old manual system. The manual system consisted of a card file with all the relevant information about an applicant and places to check off the status. The assistant director made an effort to improve the accuracy and timeliness of the computer data base. When it improved to where he felt it could be the primary system, he abolished the manual system. Since the WISE system is interactive, all inquiries could be made using the computer system. Unfortunately, this made almost everyone in the office very nervous. There was a certain security in the card file. So the assistant director asked the computer center to have the computer generate a set of cards with the relevant information about each applicant. This made everyone happy; the computer record was still the primary record, and the card file was intact.

Fundamental changes in attitudes brought about by the DSS were not as sweeping as one would always like. Anyone who designs and implements decision support systems likes to think that his or her work will revolutionize the operation of the organization. This seldom happens, however. Organizations have a great deal of momentum. They do change in subtle ways, however, which may lead to major changes in the long run. Any changes in attitudes at Guilford during this five year period are particularly hard to evaluate because the administration of the College changed in the middle of the period. It would be presumptuous of us to claim credit for our DSS for causing changes when the whole top administration (including president) changed. We did notice that there was less of a fixation on numbers than there had been in the past. There seemed to be less day to day monitoring of admissions by top administrators than there had been in the past. Admissions was being trusted more to do the job. One change in attitudes that probably was partially caused by the DSS was a lessening emphasis on the number of applications. The DSS showed quite clearly that the application flow fluctuated randomly from year to year, and that the more important number was the percent of those accepted who paid and enrolled. Consequently, the College was becoming more selective in its SEARCH mailings, and was focusing on those applicants who had a high probability of enrolling.

CONCLUSION

A decision support system, because it is used by people, will change and adapt just as peoples' attitudes and even organizations change and adapt. And their changes and adaptations are not always predictable, or even desirable. The authors went back to North Carolina with certain preconceived notions about what the admissions DSS would look like after five years, and found that almost all of those notions were unfounded. The users of the system had expanded it more than we had expected, and in some imaginative ways. The dropping of the scoring system was not surprising, and upon reflection, we decided it would have been better suited for transfer students and older students for whom SAT scores and high school rank are less meaningful as predictors of performance. The downgrading of the forecasting system was disappointing, but upon consideration of the people involved, was not unusual, and perhaps should have been predictable. The basic attitude changes that did take place were gratifying, but it would have been more gratifying if they had been more fundamental and widespread in the organization. In retrospect, the DSS was installed at a time when small colleges were in a time of crisis (and may still be). In times of crisis, when college administrators have a system they perceive is working, they are reluctant to try something new. Risk taking is more palatable when the costs of failure are not catastrophic.

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LONG RANGE SYSTEMS PLANNING

MEETING COMPUTER NEEDS THROUGH THE IDENTIFICATION OF INSTITUTION-WIDE PRIORITIES

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Selection of a computer system to meet the instructional, research, and administrative needs of a four-year liberal-arts college requires careful planning given the multitude of options from which to choose. Long-range Systems Planning (LSP) was introduced recently at Hope College as a rational alternative to "shopping for hardware." LSP is a systematic method of defining computer needs, assigning institution-wide priorities to the meeting of those needs, identifying appropriate software -- existing or to be created -- to meet the needs, and finally selecting hardware which will support the software and do so in light of the priorities identified. The outcome of a six-month analysis and search at Hope has been the selection of a system -- software and hardware -- which reflects the needs and priorities of the entire institution.

In 1966, a young theoretical physicist with extensive computer experience joined the Hope College faculty. Because the College had no computer, he began an immediate search for a system (really a machine...) which would perform the calculations required for his research. Further, in order to persuade College officials to invest in any computer, the performance/cost ratio needed to be high and administrative applications possible.

The 1130 system had just been announced by IBM. It was a "state-of-the-art" machine, had a well-developed library of tested software, would do scientific calculations, and had the promise of being able to perform administrative functions, as well.

Selection of the College's first computer system was made by several interested faculty following conversations with representatives from IBM. Purchase of an 1130 system was recommended to the College administration. With the assistance of an N.S.F. matching grant, Hope College acquired its first computer.

In the next five years, computer usage at Hope grew rapidly. Applications expanded from physics research to physics instruction, then to instruction in mathematics. The first FORTRAN course was taught by a physicist at the request of senior students. Simultaneously, a number of administrative functions were computerized; the first applications were keeping student records and performing accounting functions; controlling budgets and maintaining development records followed.

Increasing academic and administrative usage brought the 1130 to its limits by 1972 in spite of several hardware enhancements. A small committee of faculty and administrators sought a system (again, really a machine...) with an acceptable cost/performance ratio that would meet the projected needs of the College for the next five to seven years. Two machines emerged from the search as viable candidates; the Sigma VI system was chosen after careful comparison and review by committee members. Hence, the College's second computer was chosen, upon the recommendation of a small, informally-constituted, committee of interested users.

Predictably, both academic and administrative usage continued to grow -- seemingly without bound -- in the next eight years. By 1980, approximately one-half of the College's twenty-two departments were using the computer as an instructional aid and student-faculty research in ten departments required computer capability. Data analysis in student laboratories, beginning with freshmen physics and extending to senior-level science courses, was commonplace. A computer science major program, established in 1972, was graduating approximately fifteen majors each year and departmental enrollments were increasing at a rate of approximately 20% per year. In the same interval, virtually all administrative functions became computer-based. The most notable example is a highly sophisticated admissions inquiry/tracking system which makes extensive use of the Sigma word processing and editing capabilities coupled to high-speed, data storage and retrieval. Financial aid records, and limited "on-line" student registration were also "brought up."

It became apparent that the Sigma -- at least as presently configured -- would not be sufficient to meet the needs projected for the decade of the 80's. Further, technology had brought the sophistication and cost of new hardware to a point where a significant increase in computing power was possible at a very modest increase in the total cost of computer services. Finally, the costs of maintaining the non-state-of-the-art Sigma hardware were growing at an ever-increasing rate.

Should the Sigma be replaced and, if so, what should replace it? A cursory examination revealed a number of possibilities, of which perhaps five to ten systems might be viable alternatives.

Historical precedent and "conventional wisdom" suggested that a careful study of current and projected needs should be undertaken by the Director of the Computer Center. A search committee was formed for the purpose of reviewing those needs and suggesting alternative ways of meeting them. Several months later, the Committee made the following recommendations:

i) that the Sigma not be retained/upgraded;

ii) that there will be a need for greater distributive processing capabilities in the future--any new system should reflect this need;

iii) that a new central computing system should be acquired to serve as a nucleus for a distributive processing network; and

iv) that serious consideration of five systems already suggested by vendors should proceed immediately.

The Committee was then requested to evaluate the five alternatives and to recommend a system (once again, really a machine...) to replace the Sigma. The Committee divided its work into five categories:

i) System software

ii) Applications

iii) Hardware

iv) Conversion and installation

v) Benchmark preparation and evaluation

Corresponding sub-committees carefully examined the proposals of the contending vendors submitted in response to a carefully formulated Request For Proposal (RFP). Several systems "came to the top" each having certain strengths, often in non-overlapping categories.

Throughout the process, but at this juncture especially, something which I call the GM-Ford-Chrysler phenomenon "reared its ugly head." Members of the selection committee had their hardware/software "favorites" much as automobile owners tend to be lifelong Chrysler, Ford, or GM drivers. As a result, the committee's report contained what can be described at best -- and most charitably -- as divided opinions, positions, and conclusions!

Following extensive discussion with the Computer Center Director, a careful cost analysis, a report to the President, and a report to the Board of Trustees, a new system was finally selected, and in June of 1981, the College placed an order for hardware.

The conversion of existing administrative software began immediately. In several weeks, difficulties of such magnitude emerged that it became clear that the system chosen would not meet the needs of the College as had been promised by the vendor and anticipated by those involved in the decision. Since no hardware had been delivered, the order for the system was cancelled in the fall of 1981.

The need to replace the Sigma became even more pressing, however, as users of the computer for both instruction and administration continued to increase.

To return the search and selection process to the "track," a small Computer Reassessment Committee was appointed by the President. This committee was composed of the Provost (chief academic officer) who acted as chairman; the Vice-President for Business and Finance; two faculty members, including the chairperson of the Computer Science Department and a member of the physics faculty; the Director of the Computer Center; and a consultant from Deloitte, Haskins and Sells. The latter member was engaged to provide an objective voice and to assist us in establishing a sound process for making a good decision. It was clearly understood at the outset that the consultant would not vote on final decisions involving software or hardware, i.e. would not participate in making the actual decisions.

The committee began its reassessment work in October of 1981. In the next several months, a number of open meetings were held to inform the user community of the progress of this reassessment. It was not surprising that faculty and staff became increasingly concerned and frustrated with the setback suffered when the order for a new system was cancelled. By now, the Sigma was severly overloaded; response times were unacceptably long and storage was severely limited.

Our consultant assisted us in implementing a rational process to insure that a sound decision would be made - "second-time around." The primary goal of this process, long-range systems planning, is to construct a foundation for the selection of computer hardware and software which is based upon institution-wide needs and priorities for meeting those needs. Unlike earlier choices, which involved "shopping for a machine," long-range system planning begins with needs and priorities, moves to software required to meet those needs in priority order, and finally to the hardware that is able to support the requisite software. Ideally, it eliminates the GM-Ford-Chrysler phenomenon!

The principal elements of long-range systems planning are:

I. A determination of all computer needs in the College by interviewing faculty and key administrators

II. Preparation of system summaries which express those needs as simply as possible

III. Development of criteria for evaluating systems

IV. Development of system narratives which describe the needs in some detail

V. Assignment of priorities for development and implementation of the systems required

VI. Preparation of a long-range plan for development and implementation, in priority order, of those systems

Specific tasks needed to complete the process were identified. Responsibilities for all tasks were assigned to various members of the committee at the outset. A tentative timetable for completion of each phase of the planning process was prepared by our consultant, then reviewed and approved by the committee.

Phase one in the reassessment process was an update of need statements. Within one week of the reassessment committee's first meeting, the faculty members on the committee had reviewed previously prepared statements of instructional and research needs. In addition, they had solicited comments from interested faculty and staff by circulating a questionnaire and by requesting written statements. Updated statements of administrative needs came along shortly thereafter. To more fully involve the entire College community in the decision-making process, our consultant agreed to talk directly with any member of the faculty or staff who wished to express a concern or opinion.

The second phase of the long-range systems planning process was the preparation of system summaries. System summaries express each need in two or three sentences. For example, the system summary for Hope's computer science major program is:

> The Computer Science Department needs to provide introductory programming instruction in advanced courses to Hope College students. It also needs to expose its students to a wide variety of architecture, environments, languages, and applications. The Department also needs to conduct a research program in experimental computer science.

Academic system summaries were prepared by the two faculty members of the committee; the director of the computer center and our consultant prepared system summaries for the various administrative areas which make use of the computer.

In approximately one month, the Committee was prepared to develop criteria by which various systems could be evaluated. Our consultant prepared a draft of the criteria to be used; the committee reviewed and, where appropriate, revised the list. This single set of criteria was used in evaluating each system identified in the first phase. Included in the criteria were:

Service to students
Service to faculty
Enrollment growth
Academic and administrative record keeping
Cost effectiveness
Physical plant maintenance
Protection of assets
Legal requirements
Planning assistance
Service to the public
Staff effectiveness and motivation
Acquisition of financial resources

Each criterion was defined; committee members then discussed and refined the definitions until they were clearly understood and agreed upon. For example, "service to students" was defined as the:

> "impact that the system will have on the ability of the College to provide instructional services that will be meaningful and viable to Hope students."

These criteria and their respective definitions became the foundation for evaluating all of the systems identified.

"Weights," indicating the priority of each of the aforementioned criteria in the College, were assigned by completing an anti-symmetric "criteria matrix." This matrix is formed by listing the evaluative criteria both "across" and "down." The elements of the matrix indicate the relative importance (plus means more important; zero means of approximately the same importance; and minus means less important) of the "intersecting" criteria. The elements were assigned in committee by the methods of consensus. It is important to remember, in this regard, that the committee consisted of the academic and financial vice-presidents, the chairperson of the Computer Science department, a faculty member representing research interests, the Director of the Computer Center, along with our consultant. Hence, it was representative of all phases of the College's operations. The vicc presidents were able to make priority judgments from broad perspectives and were empowered to do so.

"Scores" for each criterion were obtained by summing rows (or columns) of the "criteria matrix." A constant was added to the scores to eliminate negative values. Finally the relative weights (priorities) were determined by normalizing the scores to a maximum value of ten.

$$\text{Criterion Weight} \equiv \frac{\text{"Criterion" Score}}{\text{Maximum "Criterion" Score}} \times 10$$

After the weights (priorities) were established, system narratives were developed corresponding to each of the system summaries which had been prepared earlier. Components of system narratives included:

System Summary
System Users
Functions to be Performed
Assumptions
Anticipated Benefits
Implementation Alternatives
Volume Statistics
User and Facility Impacts
EDP Impacts

Informed by system narratives, each system was examined in light of the criteria. A rating ranging from 0 to 5 was assigned to each criterion. The total number of points for a given system was obtained by summing the products of rating and corresponding weight for each criterion. The number of total points was taken as the final measure of the relative priority to be assigned to each system in the overall plan of development and implementation.

Ideally, the list of systems, in order of total points, would point first to the necessary software and then to the hardware needed to support it. The final list, in priority order, is:

Computer Science
Instruction
Faculty/Student Research
Financial Aid
Academic Records
Business Functions
Admissions
Computer Center
Alumni/Development
Academic Administration
Outside Users
Library Circulation
Student Services
Personnel
College Relations

Based upon institutional priorities, software systems which would best meet the needs - including languages, processors, and administrative data processing packages - were identified.

Immediately following, a revised Request For Proposal (RFP) was prepared to identify hardware which would support the software systems. This RFP was based upon a clear agreement on institution-wide priorities for computer services. Further, it was much more detailed than the first version, especially in those sections describing requirements in which actual performance was not as promised by the vendor chosen earlier. The RFP was sent out in mid-February and vendors responded by March 1. Clarifications were requested and revised proposals were received by mid-March.

With the vendors' proposals in hand, a number of site visits were scheduled to installations with software and/or hardware which simulated as nearly as possible the system environment envisioned for hope College. As a result of the site visits and software requirements, the number of vendors in the final "cut" was reduced to two. The long-range planning results indeed pointed to final choices of software and hardware made early in May - little more than six months from the beginning of the long-range systems planning process.

Other decisions involving specific software packages to meet system needs and detailed hardware configurations were worked out in the next two months.

In summary, the long-range systems planning process provided a rational alternative to "shopping for hardware." Given the whole host of seemingly viable alternatives which exist currently, we believe it to be a very sound method for making choices of computer software/hardware systems informed by institution-wide needs and priorities.

MICROCOMPUTERS IN THE SMALL COLLEGE ENVIRONMENT

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Microcomputers have had a profound impact on the computer industry in the past few years. They are expected to have a dramatic impact in the next few years. The sales potential has been extimated to be over $25 billion over the next 3-5 years. The most visible area has been their use as personal computers, making their way into millions of homes nationwide. They have also become prolific in small businesses, performing a multitude of business functions. They are now starting to have an impact in the small college environment. As you would expect, individual departments have received grant money and been given special budget allocations to purchase microcomputers to enhance research, increase the level of educational services, and improve delivery systems. But now, microcomputers are starting to impact all areas of small colleges.

But, what are microcomputers? What are their limitations? What are their potential uses in the small college environment? What should be considered when purchasing a microcomputer or a network of microcomputers? This paper will focus on these questions and explore, in depth, two specific uses of microcomputer networks in a small college environment.

WHAT IS A MICROCOMPUTER?

Ask any six knowledgable people to define a microcomputer and you may get six different answers. Some would differentiate a microcomputer by price: a system under $25,000, usually in the $100-5000 range. Others would define a microcomputer as a computer that uses an 8 or 16 bit/word processor (although they would say there are some 16 bit minicomputers). A third definition of a microcomputer would be a computer in which the CPU resides on a single chip. Another way to distinguish a microcomputer is by its speed, most microcomputers operate at .08-.4 million instructions per second (MIPS). In the world of computers, this is extremely slow. A fifth definition might be a computer in which there can only be one user at a time (although there are some multi-user microcomputers). Finally, most microcomputers can perform only one task at a time.

Many people would probably combine two or more of the above characteristics (cost, processor, size, speed, number of users, and number of tasks) and come even closer to an actual definition.

To simplify things, let's establish the definition of a microcomputer as:

- an inexpensive (usually under $5000)
- 8 or 16 bit/word processor
- on a single chip
- with a speed of .08-.4 MIPS, that
- supports a single user (unless enhanced), and
- processes one task at a time.

Examples of microcomputers include Radio Shack's TRS-80, Apple, Commodore, IBM's PC, Osborne, Xerox's 820, Altos, Vector Graphics, Franklin Ace 1000, Olivetti's M20, Timex, Micro-Five, CROMECO, DEC's Decmate, Hewlett Packard's Series 80, and a host of others.

Let's get one thing straight before we go further -- microcomputers are usually small in size, but not necessarily small in capability. Up to a year or two ago, peripherals were limited. Now the industry of providing peripheral equipment to microcomputers is as wide open as the microcomputer field itself. Some of the devices you can attach to a microcomputer include:

- Monitors
- Floppy disk drives

    * 5¼"
    * 8"
    * 3¼" or 3½"
    * 14"

- Winchester (hard) disk drives
- Printers

    * Dot matrix
    * Letter quality
    * Other

- Voice synthesizers
- Modems (that allow you to talk with other computers)
- Analog devices
- Cassette tape
- Communications interfaces (RS-232)
- Cartridge tape
- Card readers
- Optical scanners (OCR character readers)
- Graphics terminals/plotting devices.

The potential for peripherals is expanding daily. As we will see, the limitations associated with microcomputers are not related to hardware per se, but rather our desire to utilize microcomputers where once a large mainframe was needed or where the people resources have not kept pace with the hardware advances.

LIMITATIONS OF MICROCOMPUTERS

There are several limitations to using microcomputers that balance their many potential uses. The proliferation of microcomputers is limited to our desire to use them where, just one to five years ago, a large mainframe would have been required. This, coupled with the inability of personnel resources and individual knowledge to keep up with the technology, have been the most limiting factors. Most of the limitations can be controlled by planning and a knowledge and understanding of each limitation. The following list highlights the major limitations of today's microcomputer systems.

Relatively Slow CPU

Small word size (8 or 16 bits/word) requires more memory operations to get/store data. Use of interpretive high level languages also slows execution. Limited instruction sets sometimes require more code. Finally, arithmetic operations with large numbers execute relatively slowly.

Limited Input/Output Capacity

Most microcomputers have limited input/output paths, restricting data transfer capacity. For example, a typical microcomputer has eight input/output slots, some of which may be used for functions other than input/output. Peripherals also tend to be slower than those used by mainframe computers.

Limited Memory Capacity

Many microcomputers are restricted to 64K (thousand) bytes of main memory, few can contain as many as 256K or 512K bytes. It should be noted that most programs that would be of use in a small college can be run within the memory constraints of most microcomputers.

Single User Constraint

Most microcomputers are single user systems, unless they have been specifically configured for a multi-user environment. By single user, we mean only one user can use the CPU at a time. Even when modified for a multi-user environment, users seldom share the CPU, but the system will contain a microprocessor for each user.

Qualified Technical People Are Scarce

People technically trained on a microcomputer system are scarce. Also training on one microcomputer system may be of limited use on a second microcomputer system. This limitation especially applies to the technical workings and configuration of microcomputer systems and the operating systems used by these machines, as well as knowledgeable people to program and teach their use.

Poor Documentation

A major problem with microcomputers is inadequate or out-of-date documentation for hardware, system software, and application software. The best documentation probably lies with the system software. Unfortunately, most application software developers do not adequately document their software.

Limited Support

Most software, training, hardware maintenance, etc., is difficult to acquire. Only in the last year or so have computer retail stores become numerous and with these stores, some "packaged" software has become available off the shelf. These stores also provide limited training and maintenance.

Haphazard Equipment Service

Equipment service is becomming available in most metropolitan areas, but microcomputer users outside these metropolitan areas still receive haphazard service. Also, service is usually obtained by bringing the equipment to the service center, a major disadvantage of the microcomputer. Quality is also haphazard, excellent at some places, but poor at others.

Lack of Security

Security is a major problem for microcomputers, both physical (access to the hardware) and data (access to the data stored). If sensitive data is stored or processed on a microcomputer, special security measures are required.

While the limitations seem lengthy, they should result in concern, not avoidance. Despite their limitations, microcomputers can become a major time and money saving tool in the small college environment.

POTENTIAL USERS IN THE COLLEGE ENVIRONMENT

Microcomputers have many potential uses within the small college environment. For ease of discussion and review, potential uses are addressed by area.

Scientific

Probably the first group to utilize microcomputers was the scientists. They quickly recognized that microcomputers would be a big help in scientific research and teaching. Chemistry, biology, physics and mathematics have traditionally lead the way in the use of microcomputers. They have been used for mathematical computations, condition monitoring, data capture, data storage and retreival, research and development, and a myriad of other uses. These uses are usually technical and tied to individual research. Use of microcomputers in this area generally encompasses a single user.

In the scientific area, it is generally the individual that takes the lead in the procurement and use of microcomputers. Scientists have usually used mainframe computers in their education or past experience. However, in the small college environment, the mainframe computers become expensive and are not always available. The microcomputer solution becomes very viable in the scientific environment.

Academic

The use of microcomputers to teach data processing has not become widespread because of their limitations, but this is changing. Several small colleges are developing microcomputers into a major data processing teaching tool. The reasons for their increasing use are their price, their availability, and ease of use. Their limitation is mainly the lack of qualified technical people that understand microcomputers and realize that they represent a viable teaching tool, especially in programming skills.

Microcomputers are especially suited to teach programming skills. Most microcomputers offer some version of BASIC. Other languages include FORTRAN, RPG, COBOL, and Pacsal just to name a few. It should be noted that most programming languages for microcomputers are not ANSI standard, but rather subsets designed for the specific microcomputer. The emphasis should be placed on the general structure of the language, the concepts that go into writing the code, and in program testing, debugging and completion. It should be noted that the languages between mainframes are not compatable either, but we still teach programming on mainframe computers.

In any academic environment, students hopefully learn the basics of programming, input/output concepts, data and file minipulation, and report production techniques. These can be done using microcomputers.

Learning Center

Most colleges have some type of learning center. These learning centers are generally aimed at the slow learner, the handicapped learner, or any student desiring additional assistance in learning. Most people have heard of Computer Assisted Instruction (CAI) or Computer Managed Instruction (CMI). These are merging areas where microcomputers are beginning to play an important part in higher education.

CAI/CMI capabilities usually are written in BASIC and allow an instructor to create custom instruction and testing on any subject. Capabilities usually include question branching, numerical approximation, and multiple choices features. In many CAI/CMI applications, student data files are created and the educational progress of each student can be monitored. Instruction can run the entire spectrum of classes, from vocational to continuing education, from accounting to zoology.

When utilized in the CAI/CMI environment, either individual microcomputer stations or clustered microcomputer systems can be used. When using individual stations, students get CAI/CMI lessons that are contained on disks from a central checkout area, load the lesson, and begin the learning experience. Clustered microcomputer systems can either be controlled from a master terminal, loading the student's microcomputer with the needed lesson, or by allowing the student to load his/her system from the master.

Another area is the use of voice synthesizers, coupled with the microcomputer, to provide audio response to the user. This is very useful to blind students. Using the keyboard, the student types into the system and receives audio feedback. Answers may then be typed into the system and immediate feedback received.

Business

Probably the first area after scientific use for the small college would be in the area of business systems. Financial accounting (accounts payable, accounts receivable, and general ledger), payroll, and fixed asset management are just a few of the business systems. Several of the smaller colleges have two or three microcomputers with disk storage and printers to handle all of their business needs. Data is captured on source documents, entered into the microcomputer, and reports are produced as needed. Software is usually written by college personnel or by systems houses that specialize in writing software for microcomputers.

The business office represents the 'traditional' use of any computer and this is not unusual in the case of microcomputers. Costs may be relatively low, a system for the business office with disk storage and a dot matrix printer would cost $4-8,000. Software would be extra and there would be little or no recurring costs.

Student Information

Student information crosses several offices within a college. Initally, the Admissions Office creates the student record; the Registrar's Office maintains the student data. Student information would encompass all personal data about a student, course work history, and, potentially, transfer courses and grade point averages. Processing student information on a microcomputer will probably be the last frontier in small colleges' use of microcomputers because of the massive data storage requirements and the need to access the data base from several areas, thus requiring a network of microcomputers. But, I see it coming. When microcomputer networks are discussed, it will become clear how student information could be processed using microcomputers.

Career Planning

Career planning programs are becomming numerous on microcomputers. One of the most widely used, SIGI (System of Interactive Guidance), was developed by ETS (Educational Testing Service) and runs on almost any microcomputer with a CP/M operating system. It is my understanding that other career planning packages are being converted to run on microcomputers.

Financial Aids

In the area of financial aids, microcomputers are used to maintain a data base of aid recipients, to store aid formulas and compute aid needs, and to print award letters to potential recipients. Other letters and notices, such as aid transcripts, letters of ineligibility due to income or grades, etc., can be produced, thus greatly reducing the manual workload in the financial aids office.

Library

Libraries can use microcomputers for circulation, cataloguing, serials control, acquisitions, audio-visual services, and library administration. For small libraries where one terminal could handle circulation, the microcomputer solution is especially viable. Again, software becomes a problem, for there is not much software for libraries on the market for microcomputers.

Word Processing

Microcomputers are widely used in all areas and industries as word processing stations. There is probably as much word processing software as any type of software for microcomputers. We have already mentioned (indirectly) word processing in the area of student information, business, and financial aids. Professional secretarial programs use microcomputers in their labs for instruction. Several colleges use microcomputers in a network to provide word processing capability to any student. In this way, all students have the opportunity to learn and use word processing for practical solutions.

Testing and Assessment

Using small card readers or optical scanners, the faculty can take advantage of microcomputers to grade and score tests. Students mark answers on a special card or optical scoring sheet and the card or sheet is read by the peripheral equipment. The test can be scored and a list of students and grades produced. In addition, individual questions can be monitored and a distribution of grades produced.

Curriculum Planning

If a small college does not have an on-line curriculum planning capability, then the microcomputer presents an excellent opportunity to automate that area of instructional development. Courses and sections can be entered and tracked as students enroll or pre-enroll. Class limits can be monitored and class rosters produced for attendance and grade reporting. As schedules are developed, classroom conflicts can be automaticly monitored. It should be pointed out that this area is new in the application of microcomputers. Software is not readily available. It does represent a real potential in the area of microcomputer networks.

Continuing Education

There is a real lack of automation in the continuing education area in many small colleges. Using a microcomputer, mailing lists can be maintained, classes scheduled, instructors assigned, and CEU credits maintained. This is an area where manual systems are prevalent, but the workload should point to automation. The microcomputer solution is very viable.

Alumni Relations

The tracking of alumni is a relatively easy task to be performed on a microcomputer. If the names, addresses, and other needed information can be received on a magnetic media (say a floppy disk), the creation of the data base is a relatively simple task. Mailing labels, donation information, and other relevant information can be maintained by the alumni relations office and used to the best advantage of the institution.

Institutional Development

Sometimes combined with alumni relations, institutional development information is a natural area for a microcomputer. Names of donees, institutions, and other people the school wishes to correspond with can be maintained. Mailing labels and letters can be produced.

Bookstore

The bookstore of a small college represents another area for the use of a microcomputer. Courses can be tracked by instructor and book usage tracked by course and instructor. Lists can be produced for upcoming terms and can be distributed to instructors to indicate book requirements. Book requisitions to suppliers can be tracked. Finally, inventory can be maintained. Inventory is especially desirable on the high dollar items (books and other high dollar inventory) within the bookstore.

Security

Security is another candidate for using microcomputers. One area is physical security of areas within the college. Microcomputers can read badges and admit card holders to non-public areas. Access can be controlled by area and monitored.

The second use in security is the monitoring of parking decal issuance and ticket issuance. Security personnel can provide lists of monies owed the school from parking violations. ID cards can also be tracked and campus alerts printed to detect the fraudulent use of lost or stolen student ID cards.

Maintenance

Maintenance and physical plant personnel can use microcomputers to maintain inventories and maintenance schedules. For each piece of college property that requires some maintenance, frequencies, maintenance requirements and costs for time and materials can be maintained. For a small investment, the college could save many dollars in repairs and replacements.

Athletics

The athletics department/area in a small school could make good use of a microcomputer. Schedules can be created, printed, modified, and reprinted. Averages can be maintained. Individual training schedules can be produced. Equipment inventories can be maintained.

These are not the only areas of use for microcomputers in the small college. The uses are only limited by the availability of technical personnel, the imagination of potential users, budget constraints, the ability to get or develop software, and the intelligent procurement of microcomputer systems that will realistically do the job.

PROCUREMENT

Before we get into microcomputer networks, some words on the procurement of microcomputers would be in order. There are a wide variety of firms in the microcomputer field. They may build, support, deliver, or represent microcomputer products to end users. Vendors form a complete spectrum and include:

- Do-it-yourself component stores
- Microcomputer manufacturers
- Turnkey distributors
- Semiconductor firms
- Large scale computer companies
- Computer stores.

Each of these vendor types tend to specialize in particular levels of the microcomputer industry. Each may have unique attributes. Exhibit 1, following this page, shows the vendors and their possible attributes.

Before jumping into the microcomputer marketplace, there are several steps that must be taken by the end user. These steps will help avoid being stampeded by vendors and falling into the pitfalls of unwise and inappropriate decisions. I know of several instances in small colleges where a microcomputer was purchased and, after the initial failure, has sat for many years unused.

- Know your requirements
    * Data
    * Transactions
    * Loads
    * Storage
    * Reports
    * Documents
- Know your limits
    * Staff
    * Money
    * Processing musts/wants
    * Technical capabilities
    * Response requirements
- Know your growth
    * Expansion
    * Peak periods/seasons
    * Special uses
    * Future dreams
- Explore the field
    * Attend demonstrations
    * Seek education
    * Meet other users
    * Know the marketplace

EXHIBIT 1

MICROCOMPUTER VENDORS

Criteria / Type Vendor	Range Of Systems	Value Added	Geographical Coverage	Support
Do-It-Yourself Component Stores	Parts Only	Availability	Local	Minimal
Microcomputer Manufacturers	Broad Spectrum, may or may not have peripherals	Manufacturer, Assembly	Broad	Good
Turnkey Distributors	Varies	Assembly, Software Support	Varies	Poor to Excellent
Semiconductor Firms	Boards Only	Manufacturer	Varies - usually limited	Minimal
Large Scale Computer Companies	Broad Spectrum	Manufacturer, Assembly, Support	Very Broad	Good to Excellent
Computer Stores	Limited Spectrum	Availibility of hardware, packaged software, limited support	Local	Limited

PARALLEL SYSTEM EXAMPLE

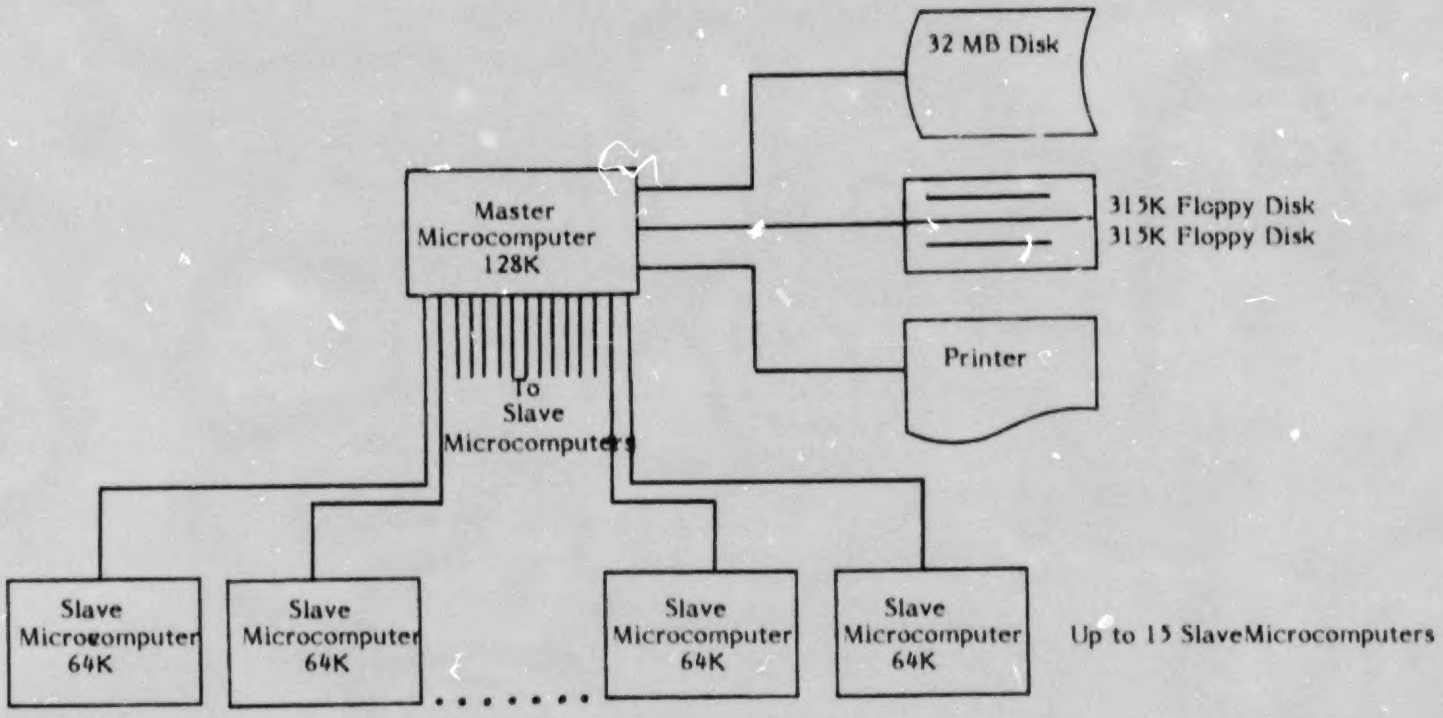

32 MB Disk
Master Microcomputer 128K
315K Floppy Disk
315K Floppy Disk
Printer
To Slave Microcomputers
Slave Microcomputer 64K
Slave Microcomputer 64K
Slave Microcomputer 64K
Slave Microcomputer 64K
Up to 15 SlaveMicrocomputers

EXHIBIT 2

- Define your directions
    - Short range goals
    - Long range goals
    - Expectations of performance
    - Life cycle usage
- Develop a Request For Proposal
    - Explicit needs
    - Define expectations
    - Measurement criteria
- Weigh the alternatives
    - Seek expert advice
    - Ask questions
    - Understand what you are getting
- Make your decision
    - Get a product that will satisfy your needs
    - Develop an implementation plan.

Even if you follow every step above, there is not a 100% probability of success. The critical element in using a microcomputer in the small college is to locate or develop the software that will meet your needs. No amount of hardware will make up for a software package that will not meet your needs.

MICROCOMPUTER NETWORKS

Two specific examples are highlighted for a network of microcomputers. If a single microcomputer is required for an application, the hardware can be procured from several sources. The software can be purchased, bought as part of a turnkey system, or developed by the potential user. In any case, the application should be fairly straightforward. It is only when microcomputers are joined to create a network system that the technology is new and the applications become virtually limitless. In these instances, microcomputers may rival mainframes in cost and utility.

One of the examples shown in this paper is currently functioning at a small college. The second example is being developed and should be installed by March 1983. These represent fairly innovative ways of using microcomputers in a milti-user environment.

Parallel Network

Exhibit 2, following this page, depicts a parallel network of microcomputers. This network is currently in use in the Learning Center of a small college. The master microcomputer controls all access to the slave microcomputers and to the disk drive and printer. The master computer is 'booted' and is them used to download specific programs to each of the slave microcomputers. Each slave then acts as a learning station. Students may select CAI/CMI lessons and proceed independently from any other student's progress. The master maintains usage information by student. The master microcomputer polls each slave for input/output requirements.

If desired by the Learning Center Director, the master computer may be 'booted' again with another operating system and can be run independently of any of the slave microcomputers. Up to 15 slave microcomputers can be attached to each master microcomputer. This configuration gives the user 16 stations (including the master) that can be used by Learning Center students without significant disk or printer requirements.

In the Learning Center cited, the printer is a letter quality printer that allows word processing to be performed by a student. Disk is a 32MB hard disk and two 315K floppy disks. The master and slave microcomputers are Vector microcomputers. Either the Micropolis or OS/M operating systems may be used by the master microcomputer. Total costs for this system is about $50,000 for 16 users, data storage, and a letter quality printer.

Serial Network

The second example, shown on Exhibit 3, is a serial network of microcomputers. In this example, each user is totally independent of each other user. This network is built around a 'Cluster' which is a cabinet that contains a master microcomputer and up to 16 independent workstations each with its own microprocessor. Using available communications software, each Cluster's master microcomputer is connected to each of the peripherals available to the 'system.' A Cluster can address up to 7 peripherals. The Cluster master microcomputers use the MP/M or the newer TurboDOS as its operating system. Each microprocessor will use CP/M as its operating system. Each peripheral contains its own microprocessor and is directly addressable by every workstation. The communications software handles all the communications and networking requirements.

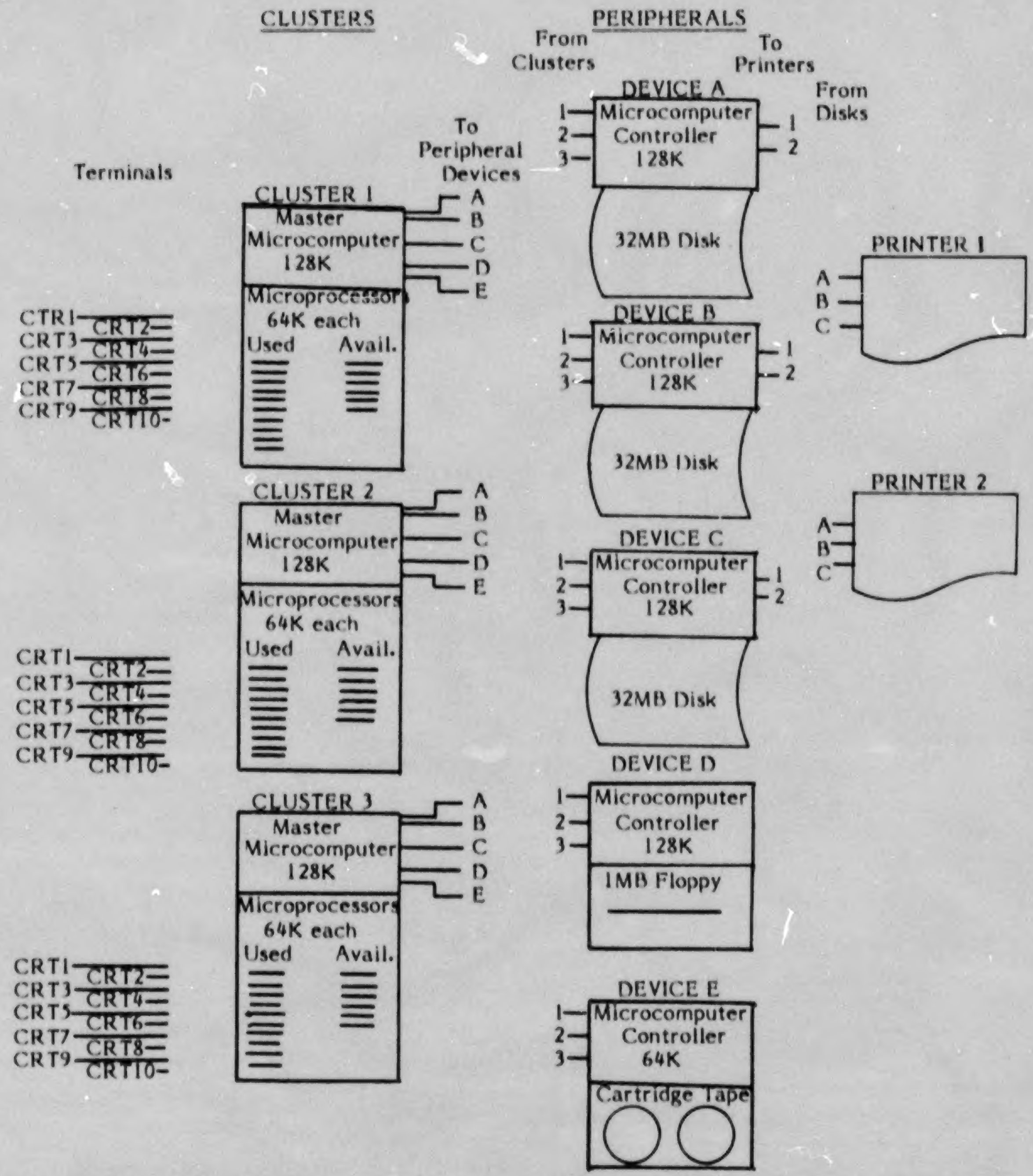
Theoretically, the system described in Exhibit 3 could be expanded to include 1024 independent workstations (users). Each Cluster master microcomputer can be connected to up to 16 workstations. Using this concept, a system as shown becomes totally redundant. If a workstation goes down, a new one can be plugged in in minutes. If a workstation's microprocessor goes down, a new microprocessor board can be plugged in in minutes. If a master microcomputer goes down, the workstations can be moved and their microprocessors placed in another Cluster (assuming there was room) and they are again useable. With redundant disk and printer capability as shown, the system can afford to lose one of the disks or printers without losing its ability to operate.

In the configuration as shown, total costs for a 30 user system is about $180,000. New workstations, along with their microprocessors, can be added for about $2000 each. If a new Cabinet and master microcomputer is required, the costs are about $5000.

Using this concept, information in the system can be reached by any user, assuming that user has the security necessary for that information. In the small college environment, Clusters could be placed throughout the college and be used for any function we have described in this paper. Segregation of academic and administrative functions would ensure a more secure system; students would not have access to student information. Maintenance is also easy. A faulty workstation can be immediately replaced and the user is back in business. A faulty microprocessor board can be immediately replaced and the workstation is back in business. Peripherals and a Cluster's master microcomputer can also be swapped. In otherwords, the system is replaceable part by part.

EXHIBIT 3

SERIAL NETWORK EXAMPLE


CLUSTERS
PERIPHERALS
From Clusters
To Printers
From Disks
To Peripheral Devices
Terminals
CLUSTER 1
Master Microcomputer 128K
Microprocessors 64K each
Used
Avail.
A
B
C
D
E
CTR1
CRT2
CRT3
CRT4
CRT5
CRT6
CRT7
CRT8
CRT9
CRT10
CLUSTER 2
Master Microcomputer 128K
Microprocessors 64K each
Used
Avail.
A
B
C
D
E
CRT1
CRT2
CRT3
CRT4
CRT5
CRT6
CRT7
CRT8
CRT9
CRT10
CLUSTER 3
Master Microcomputer 128K
Microprocessors 64K each
Used
Avail.
A
B
C
D
E
CRT1
CRT2
CRT3
CRT4
CRT5
CRT6
CRT7
CRT8
CRT9
CRT10
DEVICE A
Microcomputer Controller 128K
1
2
3
1
2
32MB Disk
DEVICE B
Microcomputer Controller 128K
1
2
3
1
2
32MB Disk
DEVICE C
Microcomputer Controller 128K
1
2
3
1
2
32MB Disk
DEVICE D
Microcomputer Controller 128K
1
2
3
1MB Floppy
DEVICE E
Microcomputer Controller 64K
1
2
3
Cartridge Tape
PRINTER 1
A
B
C
PRINTER 2
A
B
C

SUMMARY

In summary, microcomputers can do almost any job that a computer would be an advantage to perform. They are no longer limited; the limitations are only in the people that use them. Microcomputers are accessable and relatively inexpensive. Be careful when considering them for your college. Usually the limiting factor in using microcomputers is the availability of technical assistance. The time is not far off when microcomputers will be the dominant computing factor in the small college environment.

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TRACK V
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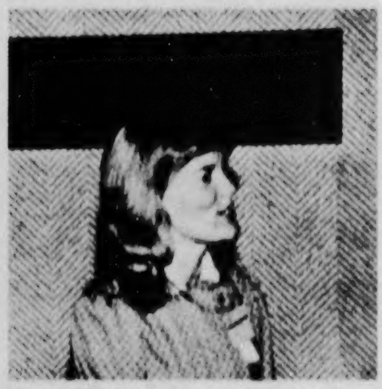
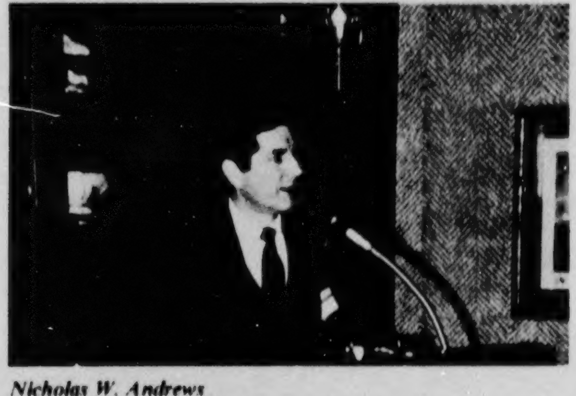


Judith Hagen
Marist College



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The State University System of Florida's Automated Student Follow-up System

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The State University System of Florida is composed of nine universities and is governed by a Board of Regents. The Florida System graduates over 21,000 students with Bachelors Degrees, over 5,000 students with Masters Degrees, approximately 1,000 students with professional degrees and approximately 700 students with Doctoral Degrees each year. The Board of Regents and the individual universities have a need to conduct follow-up studies of these graduates to determine the relevancy of the degree programs offered, the value of the education offered to both individual graduates and to the society at large, and the need for program adjustments.

This paper details the development of an automated follow-up system developed by the Board of Regents Staff to provide the needed follow-up information. This system utilizes computer data files maintained by the State University System and by the Florida Division of Employment and Labor Security.

The State University System maintains computer files on all students enrolled in state universities. The Division of Employment and Labor Security maintains computer files containing Workmen's Compensation rolls. These two sets of records are utilized to conduct follow-up studies. As it currently exists, this system allows the State University System to follow-up on the in-state employment and educational patterns of over 80% of its graduates.

The Need for Supply and Demand Information on College Educated Manpower

Most institutions of higher education have continuously expanded the academic programs they offer while rarely discontinuing existing programs. Most new programs are started as a result of newly developed needs of the labor market. Once started, however, an academic program develops a life of its own and its continued existence may become independant of changes in labor market needs.

Any substantial lack of agreement between a university's curriculum and the needs of the labor market would tend to bring about, or accentuate, two competing pressures; that is (1) the institution's desire to continue to offer programs which, while somewhat lacking in their relevance to the present labor needs of society, nonetheless are deemed to have other values, and (2) the university's obligation to provide its graduates with marketable skills. Institutions need to keep constantly abreast of the extent to which these competing pressures are operating.[1]

In recognition of this need, the Florida Board of Regents has adopted a set of criteria for establishing new academic degree programs. These criteria must also be addressed in a systematic and periodic review of existing degree programs. As would be expected, the criteria concern the human, fiscal and material resources available to a degree program; access to the program by the state's citizens; program quality; articulation of the program with other degree programs and the role and scope of the university offering the program. At least three of the required criteria for establishing new programs and evaluating existing ones necessitate supply and demand information on college-educated manpower:

- -The requirements of business, industry, government or other institutions.
- -The characteristics and geographic sources of students to be served; and
- -The nature and location of employment opportunities.[2]

Continuous follow-up study of the graduates of Florida's state universities can provide much of the information the Regents and the universities need concerning the demand of Florida's economy for university graduates. Follow-up studies will provide information concerning which discipline majors are most in demand, which industries pay the highest or lowest salaries, and which geographic regions of the state offer the most or least employment opportunities to university graduates. Such manpower supply and demand information is useful to the Board of Regents in their decisions concerning program initiation or expansion and in their periodic evaluation and adjustment of existing programs. In addition, such information can be is a useful aid to students in their educational and career planning.

The Mechanics of the Student Follow-up System

The State University System Data Base consists of a series of computer data tape files submitted periodically to the Board of Regents Office by each of the nine state universities. One of these computer files, the

Student Data/Course File, includes information on every student enrolled in the State University System and the courses the student has taken. Table I is a listing of the data elements included on this file. A Student Data/Course File is submitted each academic term by each university. The Board of Regents Office creates a master file for each academic term from the individual university tapes.

For the purposes of the followup study, a subfile of information on only those students graduating within a given year is pulled from the master files of the academic terms of the year. This graduating student file includes all of the data elements of the parent Student Data/Course File on each graduating student. From this graduating student file another subfile tape is generated which includes the names and social security numbers of all of the graduates. This computer tape is forwarded to the Florida Department of Labor and Employment Security where it is matched with Workmen's Compensation files.

The Florida Department of Labor and Employment Security compiles quarterly data tapes on all employers in the state who provide unemployment compensation coverage for their employees. This now covers all state and local workers, all companies employing one or more persons, some agricultural workers and some domestic workers. The Department estimates that at least 98% of all employers in Florida are in these files.

Once the Department has the computer file of university graduates' names and social security numbers, it runs a match program is run to identify which of the graduates appear on the Workmen's Compensation files as employees. Whenever the Department identifies a university graduate as

Table I
Data Elements Included in the Student Data/Course File
State University System of Florida
Management Information System

Student I.D. Number
Student Name
Student Birth Year
Sex
Race
Nation of Citzenship
State at Time of Entry
County at Time of Entry
County of Residence
Student's Date of Entry
Type of Student at Date of Entry
High School Code
Last Institution Code
Degree-Highest Level Held
Degree-Level Sought
Student's Classification Level
Student Program/Institutional Degree Program
Student's Budget Entity
Fee Classification-Residency
Fee Classification-Kind
Fee Waiver Information
Fee Waiver Kind
Fee Waiver Amount
Reporting Institution
Term Identifier
Dual Enrollment Identification
CLEP-College Level Examination Program
CLEP-English Credit
CLEP-Mathematics Credit
CLEP-Natural Science Credit
CLEP-Humanities Credit
CLEP-Social Science Credit
CLEP-Subject Exam Credit
Department Exam Credit
Other Tests and Methods-Credit
Cumulative Hours Accepted (Transfer)
Maximum Credit in Supervised Teaching
Maximum Credit in Supervised Research
Doctoral Candidancy Flag
Total Hours Earned at Current Student Degree
Institutional Hours for GPA
Total Institutional Grade Points
Term Credit Hours Earned
Term Credit Hours for GPA
Term Grade Points Earned
Degree Granted-Level
Institutional Degree Program
Degree Program Fraction of Degree Granted
Current Term Course Load
Common Course Prefix
Common Course Number
Common Course Outside Indicator
Course Section Number
Student Section Funding Flag
Course Section Type
Course Section Location-County
Course Section Location-Campus
Department/Account Number-Course
Course Budget Entity Code
Course Program/Program Category
Continuing and Cooperative Education Flag
Student Section Credit
Grade Awarded

an employee, it provides the following data elements on that individual: social security number, employer suffix, year and quarter in which wages were earned, first three characters of the employee's surname, number of weeks worked during the quarter, total wages earned during the quarter, and the Standard Industrial Classification (SIC) code of the industry where employed. Table 11 is a listing of the SIC codes.

There is a problem with the use of the SIC code in that it identifies the industry in which a university graduate is employed, but not the occupation or job of the graduate . For example, a secretary who works in a hospital would have a SIC code for a health related industry rather than a business related one. As a result of this, graduates may appear to be working out of their fields when actually they are not.

When the Board of Regents Office receives this employment information from the Department of Labor and Employment Security, the data is added to the graduating student file. One final step is necessary before the graduating student file can be used in conducting the follow-up study. University graduates may decide to continue their education by earning graduate degrees instead of seeking employment. Accordingly, the graduating student file from a given academic year is matched with the State University System Student Data/Course File of the fall academic term of the following academic year. Whenever a graduate is found to be reenrolled in a state university during the fall term, the following data is added to the graduating student file; the reporting university which the student is now attending, the degree level sought, the degree program and the hours in

Table 2
Standard Industrial Classification (SIC) Codes

01	Agri. Prod-Crops
02	Agri. Prod Livestock
07	Agri Services
08	Forestry
09	Fishing, Hunting, Trap
10	Metal Mining
11	Anthracite Mining
12	Bituminous Coal, Lign
13	Oil & Gas Extraction
14	Nonmetallic Minerals
15	Gen Bldg Contractors
16	Heavy Const Contract
17	Special Trade Contra
20	Food & Kindred Prod
21	Tobacco Manufactures
22	Textile Mill Prod
23	Apparel & Oth Textil
24	Lumber & Wood Prod
25	Furniture & Fixtures
26	Paper & Allied Prod
27	Printing & Publish.
28	Chem & Allied Prod
29	Petroleum & Coal Pro
30	Rubber & Misc Plasti
31	Leather & Leather Pr
32	Stone, Clay, Glass Pro
33	Primary Metals Indus
34	Fabricated Metal Pro
35	Machinery, Exc Elec
36	Elec & Electro Equip
37	Transportation Equip
38	Instr & Related Pro
39	Misc Manufact Indus
40	Railroad Transportation
41	Local Passenger Transportation
42	Trucking & Warehouse
43	US Postal Service
44	Water Transportation
45	Transport By Air
46	Pipe Line Exc Nat Ga
47	Transport Services
48	Communication
49	Elec Gas & Santi Serv
50	Whole Trade-Durable
51	Whole Trade-Nondurable
52	Build Mat Garden Sup
53	General Merchanise
54	Food Stores
55	Auto Deal & Serv Stat
56	Apparel & Accessory
57	Furniture & Home Fur
58	Eating & Drinking
59	Misc Retail
60	Banking
61	Credit Agencies
62	Security, Comm Broker
63	Insurance Carriers
64	Ins Agent Broker Sev
65	Real Estate
66	Comb Real Estate Ins
67	Holding & Oth Invest
70	Hotel & Oth Lodging
72	Personal Services
73	Business Services
75	Auto Repair, Services
76	Misc Repair Services
78	Motion Pictures
79	Amusement & Rec Servic
80	Health Services
81	Legal Services
82	Educational Services
83	Social Services
84	Museums, Botan, Zoo
86	Membership Organizat
88	Private Households
89	Misc Services
91	Exec, Legis, General
92	Justice, Public Order
93	Finance, Tax, Mon Poli
94	Admin of Hum Resource
95	Environ Quality & Hous
96	Admin of EC Programs
97	Nat Security & Intl
99	Nonclassifiable Estb

which enrolled. At this point, the graduating student file contains the data necessary to conduct the follow-up study.

Results of the Follow-up of 1979-80 SUS Graduates

Using the mechanisms and procedures just described, the State University System Central Office conducted a follow-up study of those students receiving degrees from a state university in Florida during the 1979-80 academic year; i.e., during the 1979 Summer Quarter, the 1979 Fall Quarter, the 1980 Winter Quarter or the 1980 Spring Quarter. Table 3 is an example of the general type of information that was generated. For example, during the 1979-80 academic year, 20,700 Bachelors Degrees were awarded to state university students. Of that number, it was determined that 3,379 baccalaureate graduates (16.3%) had reenrolled in one of the nine State University System institutions the following academic year (Fall 1980 Academic Quarter) as graduate students or in some other student capacity. Of the 20,700 baccalaureate graduates, 17,129 (82.7%) were employed in Florida during 1980. There was considerable overlap between those who were employed and those still enrolled. Many graduate students combine work and school. However, of the 17,129 baccalaureate graduates who were employed, only 9,612 were employed full-time; that is, 46.4% of the total number of baccalaureate graduates. For the purposes of this study, a person was defined as "full-time employed" if that person earned a weekly wage equal to or exceeding the minimum wage ($3.10 per hour) for a 40 hour week; i.e., $124 per week or more. Finally, it couldn't be determined what happened to

Table 3
Follow-Up Study of SUS Graduates
1979-80 Academic Year Graduates

	Total Number of Graduates	No. Still Enrolled in SUS[1]	Total Number Employed[2]	Number of Full-Time Employed[3]	Where-Abouts Unknown
Bachelors Degrees					
No. of Graduates	20,700	3,379	17,129	9,612	2,308
% of Total Graduates	100.0%	16.3%	82.7%	46.4%	11.2%
Masters Degrees					
No. of Graduates	5,074	826	4,052	2,709	596
% of Total Graduates	100.0%	16.3%	79.9%	53.3%	11.7%
Professional Degrees					
No. of Graduates	875	34	684	414	180
% of Total Graduates	100.0%	4.0%	78.2%	47.3%	20.5%
Doctoral Degrees					
No. of Graduates	699	36	570	255	93
% of Total Graduates	100.0%	5.2%	81.5%	36.5%	13.3%
Total All Degrees					
No. of Graduates	27,347	4,275	22,435	12,990	3,177
% of Total Graduates	100.0%	15.6%	82.0%	47.5%	11.6%

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[1] As of the 1980 Fall Academic Term

[2] Includes those who are employed while attending a state university and working on another degree

[3] Here a full-time employee is defined as one earning the same or more than the minimum wage for a 40 hour week; i.e., $124 per week or more.

t/followup study of sus grads

2,308 (11.2%) of the 1979-80 baccalaureate graduates. These students couldn't be found on either the 1980 Fall Quarter Student Data/Course File as being reenrolled in a university, nor on the 1980 Workmen's Compensation Files. These people could be self-employed, they could be unemployed, they could be in the military, they could be attending a school or college in Florida other than a state university or an out-of-state school, they could be employed out-of-state, they could have died, etc. Of this "where-abouts unknown" group of 2,308, it is known that 286 of them were originally out-of-state residents when they first enrolled in a state university. Accordingly, it could be assumed that roughly that many left the state or country when they graduated.

From the above figures it is apparent that the use of Workmen's Compensation computer files and State University System computer files of enrolled students allow the State University System of Florida to track the employment and education of 88.8% of our baccalaureate graduates within the year after they graduate. Comparable figures for state university Masters Degree, professional degree (medicine, dentistry, pharmacy, veterinary medicine and law), and Doctoral Degree graduates are also presented on Table 3. It will be noticed that a greater portion of the professional degree graduates (20.5%) were not found either working or back in school. This is probably explainable by the fact that many professional degree graduates become self-employed and thus would likely not be covered by Workmen's Compensation.

The follow-up study also allows the generation of some interesting information concerning the salaries earned by State University System graduates. Table 4 displays the average salaries earned by 1979-80

Table 4
Average Salaries of 1979-80 State University System Graduates Who Were Employed Full-time in Florida During 1980 and Percent of Graduates Employed By Major Discipline and By Degree Level

	Bachelor Degree Graduates		Master Degree Graduates		Professional Degree Graduates		Doctoral Degree Graduates	
	% Employed	Average Salary	% Employed	Average Salary	% Employed	Average Salary	% Employed	Average Salary
Agriculture	34.9%	$13,059	25.5%	$12,752			21.6%	$14,683
Architecture	49.0%	14,416	42.7%	17,638				
Area Studies	25.9%	8,619	11.1%	15,896				
Biology	39.1%	11,190	45.5%	12,588			43.6%	13,973
Business	48.1%	14,139	50.6%	22,622			27.3%	24,099
Communications	39.0%	11,920	37.8%	12,839			36.4%	24,827
Computer Science	48.3%	17,124	56.3%	22,477				
Education	56.9%	12,613	65.2%	17,244			49.3%	22,086
Engineering	44.3%	19,374	33.9%	18,577			47.4%	19,687
Fine & Applied Arts	31.2%	11,469	30.3%	11,750			7.7%	22,573
Foreign Languages	32.5%	10,398	25.0%	14,916			66.7%	22,357
Health Sciences	63.4%	15,896	50.5%	16,755	32.4%	$17,462	14.3%	16,937
Home Economics	42.1%	10,258	88.9%	12,921			21.4%	13,117
Law			44.2%	16,988	56.2%	16,797		
Letters	35.2%	10,899	41.2%	13,373			41.5%	17,403
Library Sciences	72.2%	9,831	43.1%	14,237			28.6%	28,040
Mathematics	47.1%	14,098	49.3%	13,452			22.2%	20,754
Physical Sciences	32.7%	12,905	28.2%	17,094			9.8%	12,205
Psychology	41.4%	11,600	54.4%	13,531			27.3%	21,179
Public Services	50.7%	13,160	54.3%	15,811			13.3%	21,593
Social Sciences	38.4%	12,129	42.4%	14,793			35.6%	20,523
Interdisciplinary Studies	30.3%	14,171	44.4%	12,379				
All Disciplines	46.4%	$13,577	53.3%	$17,230	47.3%	$16,967	29.1%	$20,300

*Here a full-time employee is defined as one earning the same or more than the minimum wage for a 40 hour week i.e., $124 per week or more.

graduates who were working full time during 1980. This information is displayed by the graduates' major discipline categories (agriculture, architecture, business, etc.) and by the graduates' degree levels. The highest average salaries earned by baccalaureate graduates in Florida during 1980 were those earned by engineering majors ($19,374), computer science majors ($17,124) and health science majors ($15,896). Likewise, the highest average salaries earned by Masters Degree graduates were those earned by business majors, by computer science majors, by engineering majors, and by architecture majors. This salary information can be displayed by individual degree program (forestry, interior design, elementary education, chemical engineering, law enforcement, etc.); by university; industry of employment (banking, general building contractor, eating and drinking establishments, etc.); by graduate age, sex or race; or by any other data element included in Table 1. Obviously, this information could be useful in degree program planning and evaluation and in student counseling.

Advantages of an Automated Student Follow-up System

There are several major advantages to the use of this graduating student follow-up system. The first is its low cost. The traditional method of conducting follow-up studies involves mailing a survey to either all graduates or to a sample of them. Mail-out surveys are rather expensive when you are following up on tens of thousands of graduates. The only direct costs involved in conductiong a follow-up based on Workmen's Compensation files and SUS Student Data/Course Files is programming and computer/machine time. If you decide that you want complete information on all graduates, you only have to send a mail-out survey to those students who aren't found employed or back in school; a much less expensive prospect than sending the survey to all graduates.

The second major advantage of this system is that it allows very extensive analysis and, accordingly, can be used to address a wide variety of needs. For example, the Florida Division of Community Colleges uses this system to track the graduates of the state's 28 public community colleges into the State University System and/or into employment within Florida. The Division provides individual reports to each public community college with detailed information on the graduates of the college's separate training programs including the industries employing the graduates and the wages paid. This information is useful at the college level and to individual students. Although the Board of Regents hasn't sent individual reports back to SUS institutions yet, this is an option which may be utilized in the future.

Another major advantage of this system is that it allows continuing longitudinal follow-up of SUS graduates. A graduating student file will be produced for the graduating students each academic year. That file can be used to conduct a graduate follow-up study after one year, after five years or after any other period. It gives the State University System a very flexible tool at very low cost to follow our graduates.

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[1] Franklin L. Duff, "The Job Market Vs. Collegiate Curricula: A Potential Conflicting Pressure;" a paper presented at The Association for Institutional Research Forum; May 3-6, 1976.

[2] The Role and Scope of Florida's Public Universities: Planning Guidelines for the State University System of Florida; adopted by the Florida Board of Regents on February 6, 1978, p.26.

PELL GRANT TAPE EXCHANGE
AT
CARNEGIE-MELLON UNIVERSITY

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DECEMBER 1, 1982

Carnegie-Mellon University (C-MU) has developed a system which helps in the processing of Pell Grant awards by the Financial Aid Office. The major feature of this system is the exchange of magnetic tapes between the Pell Grant Program and C-MU. The secondary benefits have been the increased accuracy of the Pell Grant awards and the lessened amount of time that it takes a Financial Aid officer to process the awards.

Over the past few years the amount of money and the number of students receiving Pell Grants has declined because of tighter student need requirements. However, the Tape Exchange program is needed as much as ever because the validation requirements have also increased. Much cross-checking of need information must still be done by hand by the Financial Aid Officer, but checking the student's eligibility and calculating his award is quickly done by the computer.

The computerized validation process is now so thorough that C-MU does not need all of the features that the Pell Grant Tape Exchange offers. In this paper I will describe how C-MU handles the Pell Grant Tape Exchange system.

PELL GRANT TAPE EXCHANGE AT CARNEGIE-MELLON UNIVERSITY

Joyce A. Wineland

INTRODUCTION

OVERVIEW OF CARNEGIE-MELLON UNIVERSITY

Carnegie-Mellon University (C-MU) is a private, co-educational university in Pittsburgh, Pennsylvania. The University is comprised of 6 colleges and 25 academic departments with a student body of 5400 of which 4100 are undergraduates and 1300 are graduate students. C-MU is particularly strong in Computer Science, Drama, and Management Sciences. Also, the University has recently signed a contract with IBM for a joint research venture to develop a network of personal computers which are tied in to the mainframe computers in the Computation Center.

Most computers at C-MU are manufactured by Digital Equipment Corporation (DEC). The Computation Center has 6 DECSYSTEM 20s and 2 PDP-11s and 1 VAX. All are linked together by DECNET. Most printing is done on a Xerox 9700 laser printer.

The Financial Aid Office is directed by Walter C. Cathie. He has a staff of 4 professionals, 1 data entry clerk, and 9 support staff plus many student workers.

The Financial Aid Office is proud of the fact that it "guarantees" its awards. When a student applies to the university, his need is calculated and a package of financial aid is compiled from all of the available sources. Many, like the Pell Grant, are identified on the Financial Aid Master File as "estimated" awards. When the appropriate forms arrive the amounts of the awards are adjusted on the Financial Aid

Master File and identified as "actual". C-MU grant funds can be included in the package and can be adjusted to compensate for any changes in the other awards.

OVERVIEW OF THE PELL GRANT PROGRAM

The Pell Grant Program, formerly known as the Basic Educational Opportunity Grant Program (BEOG) is the largest federally-funded financial aid grant program. About 4 years ago, the Pell Grant Program instituted a program of exchanging computer tapes of the information that would otherwise be recorded on paper.

Carnegie-Mellon University began participating in this program during the 1981-82 academic year. Computer programs verify student eligibility and compute accurate awards as they cross-reference several files of information. One program writes a tape which is sent to the federal government as documentation of the Pell Grant expenditures to-date. In addition, the programs generate accurate transactions to the student's account.

PROCESSING PELL GRANTS BY HAND

When the Pell Grant Program is administered by hand, this is roughly the flow of paper:

1. Student files an application with the Pell Grant Program.
2. Student receives a Student Aid Report (SAR) from the Pell Grant Program.
3. Student takes the SAR to his Financial Aid Officer.
4. The Financial Aid Officer validates the SARs.
5. The Financial Aid Officer calculates the student's Pell Grant award from the Aid Index on the SAR and the institution's costs.
6. Periodically, the Financial Aid Officer mails the validated SAR forms to the Pell Grant Program in Washington, D.C. along with a Progress Report of expenditures to-date.
7. After the final Progress Report has been filed, the Pell Grant Program in D.C. mails to the institution a Student Validation Roster (SVR).
8. The Financial Aid Officer corrects the SVR and returns it.
9. The Pell Grant Program in D. C. mails the Final Roster to the institution.

PROCESSING PELL GRANTS BY TAPE EXCHANGE
PELL GRANT PROGRAM OFFICE'S PERSPECTIVE

A Recipient Data Exchange Specialist can be reached at (202)447-9001. The address is Systems Support Section, Pell Grant Branch, Division of Program Operations, OSFA, U. S. Dept. of Education, Room 4651 ROB-3, 400 Maryland Avenue Southwest, Washington, D.C. 20202, Attention: Recipient Data Exchange Specialist.

The same application processing organization in California which sends the Applicant Tapes to the schools also sends a tape of eligible students to the Pell Grant Program in D. C. This information is kept on a Recipient History File and is used to check the SARs that the schools return. The Student Validation Roster is also produced from this file at the end of the academic year.

PROCESSING PELL GRANTS BY TAPE EXCHANGE
C-MU'S PERSPECTIVE

STUDENT'S PERSPECTIVE

A student may apply for a Pell Grant by using any of the applications processed by one of several organizations. After the Pell Grant Program processes the application, it sends the student a Student Aid Report (SAR) which he takes to the Financial Aid Office of the school that he is attending.

If the student's financial situation changes, he notifies the Pell Grant Office and he is sent a revised SAR with a revised Aid Index. He must take this revised SAR to the Financial Aid Office where the change is entered into the system which calculates the revised award. The student's C-MU award may be modified to counterbalance the change in the amount of the Pell Grant award. Both the change in the Pell Grant and the C-MU award are then reflected in the Student Accounts Receivable file.

FINANCIAL AID OFFICE'S PERSPECTIVE

When a student brings in his SAR, the Financial Aid Officer who is responsible for the Pell Grant Program, Linda Anderson, verifies the information with his IRS 1040 Federal Tax Return, Financial Aid Form, and other information in the student's folder.

The data entry clerk then enters the Aid Index by using an on-line data entry program which calculates the student's actual Pell Grant award and puts it onto the SAR Facsimile File.

The Pell Grant Program in California sends a tape monthly of all students who requested that their information be sent to C-MU. This tape is the Applicant Roster tape. It is used to print a report of those students who are eligible for a Pell Grant but who have not turned in their SARs. The Financial Aid Office then contacts those students.

Periodically, a program is run which checks the current status of the students. It recalculates each student's Pell Grant award. The program updates the file of SARs and writes transactions which will be used to update the Financial Aid Master File. These transactions may also adjust the C-MU award to compensate for the change in the Pell Grant award.

In November, March, and July, C-MU writes a tape of all SARs which have been received since the last SAR tape was sent, along with the amount of the payments. This SAR tape is sent to Pell Grant Program in D.C. along with a tape dump, a transmittal form, and a Progress Report from the Financial Aid Office. The Pell Grant Program processes this tape and returns it to the Financial Aid Office along with an error report. A tape of the errors is also returned, but the Financial Aid Office does not use it.

The Financial Aid Office at C-MU has decided to not make use of the tape exchange of the Student Validation Roster (it contains the information concerning all of the students which C-MU sent on the SAR tapes and verifies the exact amount of Pell Grant expenditures) because the verification process is simple enough at this point to handle manually.

ADMINISTRATIVE SYSTEM'S PERSPECTIVE

Administrative Systems, the applications programming department, has written 7 programs and subprograms and queries to process the Pell Grant data and exchange information by magnetic tapes. (A minor problem arose when we discovered that the Pell Grant Program used EBCDIC but the DEC computers use ASCII.) The programs and subprograms are written in COBOL and the queries are written in a DEC query language called IQL. One program runs on-line and the rest are run in batch. Processing the transactions to adjust the awards on the Financial Aid Master FIle and the Student Accounts Receivable File is done using the regular batch file maintenance procedure.

One new file now exists because of the Pell Grant Tape Exchange system. It is called the SAR Facsimile File because it contains all of the information that is needed to recreate a SAR and process the tapes.

The programs which were written especially for the Pell Grant Tape Exchange are:

1. **On-line data entry of Student Aid Reports** onto the SAR Facsimile File.

2. **The mass update program which recalculates the Pell Grant award and updates the SAR Facsimile File:** This is needed because information on one of the other files which were used to calculate the award in program #1 can change. The output of this program is a report of these differences and a file of transactions to update the Financial Aid Master File with the revised awards.

3. **A subprogram for program #2** writes transactions to update the Financial Aid Master File with the recalculated Pell Grant award and the adjusted C-MU award.

4. **A subprogram to programs #1 and #2 to recalculate the Pell Grant award:** It reads the SAR Facsimile File to find the Aid Index; the Student Accounts Receivable file to find the Tuition charges which identifies whether the student is full-time, 3/4-time, or 1/2-time; the Student Records Biographical file to determine whether the student is enrolled and his housing status; the Financial Aid Master file to find the current Pell Grant award and C-MU award. Finally, this subprogram looks up in a table the Pell Grant award and returns it to the calling program.

5. **The Applicant Tape program:** It reads the Applicant Tape and the other files mentioned above searching for students who are eligible for a Pell Grant but who have not turned in a SAR.

6. **The program which writes the tape of SARs** three times a year from the SAR Facsimile File. It also updates the file with a flag so that, unless the student turns in an updated SAR, that SAR is not sent on the next tape.

7. **The queries** get simple lists of the students who are on the SAR Facsimile File.

CONCLUSION

Walter Cathie anticipates that the type of institution will partly determine the usefulness of the Pell Grant Tape Exchange system. A Community College which has many low income students will have a higher percentage of them receiving Pell Grant aid and will find the system very useful. However, a Private College may have higher income students and a lower percentage of them receiving Pell Grant aid, so the system may have less priority for them.

When the Financial Aid Office began planning the use of the Pell Grant Tape Exchange system several years ago, they expected that the most useful part would be the Applicant Tapes. However, the most useful facet has been the SAR Facsimile File. Since so much validity checking is done by hand and by computer, the program to write the SAR magnetic tape is very simple. There are so few errors that there is no need to computerize the processing of the error tape that is returned. The Student Verification Roster tape facility is also not used because there are so few students with inconsistencies that Linda Anderson says "it is easier to do it by hand".

"Accuracy is the most important thing" about the system, says Linda Anderson. It catches people who are not enrolled, part-time and graduate students, and calculates the accurate award.

One advantage that Mr. Cathie has found in this system is that he is more confident in guaranteeing awards. Since he gets better accuracy by using this system, Mr. Cathie can more carefully budget the money from the various sources at his disposal.

THE END

THE EXECUTIVE DATA BOOK:

KEY DATA SUMMARIES FOR EXECUTIVE MANAGEMENT

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The development of a computer produced Executive Data Book has fulfilled a long-standing desire by executive management of Cuyahoga Community College for concisely formatted, timely data that clearly communicates information on internal operations as well as on key indicators of the external environment. Over the past five years, the College has significantly upgraded its computer hardware and software. New administrative computing systems have been installed in the areas of financial accounting and reporting, budget preparation and administration, student registration and records, faculty assignment and workload reporting, and position control and payroll systems.

These new systems have resulted in an explosion of available data and reports. The sifting of this information, the formalization, consolidation and structuring of the data for executive management has made available, in the Executive Data Book, a looseleaf set of reports generated by the computer and designed for executive overview of key areas of interest. The Executive Data Book has been created by using report formats stored in memory combined with periodically updated data files. Maintenance and update of data files is the responsibility of the organizational unit with functional responsibility related to the content of the data files. The successful production of this summary data for executive management has been made possible by: 1) the availability of data-base extracts of key operating and summary data to largely eliminate the manual effort that would otherwise be required; 2) a powerful computer driven financial modeling package that automates the data file manipulation process and the production of desired reports.

THE EXECUTIVE DATA BOOK:
KEY DATA SUMMARIES FOR EXECUTIVE MANAGEMENT

INTRODUCTION

Cuyahoga Community College has, over the past five years, significantly upgraded its computer hardware and software resources. Although the bulk of this effort has focused on improved transaction processing, the sizable expenditures made for these enhanced capabilities has raised executive management expectations for authoritative and highly relevant data for decision making.

This paper will describe the processes followed by the College in producing executive level reports in the format of an Executive Data Book. These processes will be described under the following headings:

- Upgrading of Computer Resources
- Acquiring a Powerful Modeling Package
- Developing the Executive Data Book Concept
- Automating the Creation of Summary Data Files
- Applications

UPGRADING OF COMPUTER RESOURCES

During the recent upgrading in computer hardware, the College has acquired a Honeywell computer (Level 66/DPS Model 1) that handles both academic and administrative functions. More than 300 terminals have been provided for on-line communication with the Honeywell computer, giving College executives and administrators on-line access not only to the computer's database, but also to user-created data files.

A concurrent upgrading in software has resulted in the installation of four major modules to provide integrated processing of the College's detailed transactions.

- The Financial Accounting Module: This module shapes the overall structure for accounting information in the general ledger system, including balance sheet, accounts payable, accounts receivable, monthly financial reporting to budget unit heads, financial aid accounting, auxiliary enterprises, restricted funds, and other specialized applications.
- Payroll/Personnel/Position Control Module: This module yields detailed information regarding each budgeted position in the College, each College employee, budgeted salary amounts as well as detailed payroll information processed for each pay cycle.
- Budget Preparation Module: This module produces on-line creation of budgets for planned financial expenditures, as well as authorized positions. Following finalization of the annual budget, this information is incorporated in the Financial Accounting Module and the Payroll/Personnel/Position Control Module to facilitate monthly budget reports to budget unit heads.
- Student Information System: The Student Information System provides detailed information regarding each section scheduled. The information includes number of students, amount of faculty effort, time and location, faculty member assigned, historic enrollment, current enrollment, and projected enrollment.

During the software upgrading process, numerous reports were defined for each of the above modules to display details of transactions as well as summarized data. However, the summary reports generated from each of these modules were the result of a fixed set of pre-programmed applications that were cumbersome to modify and were not particularly responsive to the changing information needs of executive management.

ACQUIRING OF A POWERFUL MODELING PACKAGE

As part of the computer upgrading process, the College was seeking a software package to support the modeling of long-range financial projections. EDUCOM's EFPM, available on a time-sharing network, was used initially for this purpose for about two years. However, the need for direct access to the College's database as part of the modeling process led the College to acquire the Interactive Financial Planning System (IFPS) from EXECUCOM Corporation, Austin, Texas.

In addition to its powerful modeling capabilities, IFPS provides several features that strongly recommend it for creation of specialized reports:

- Ease of use.
- Powerful set of executive commands.
- On-line access to data files.
- Ability to manipulate, consolidate, edit, scale, recombine, etc. data files.
- Ability to use "template" models with a variety of different data files.
- Great flexibility in formatting reports.

As a result of having these IFPS capabilities, the College moved from using the modeling package for long-range financial analysis only, to making far more comprehensive applications. It soon became apparent that by properly designing the College's information producing resources, it would be possible to use IFPS to produce a series of executive level summary reports that could respond to the dynamic information needs of the College's top management.

DEVELOPING THE EXECUTIVE DATA BOOK CONCEPT

The impetus to develop the Executive Data Book grew out of several information needs expressed by the College's executives:

- Data consistently formattted and authoritative.
- Data provided on a regular and timely basis.
- A unified presentation of data (within one cover) that would incorporate the bulk of executive information needs.

Although the regularly produced transaction-driven reports provided abundant details to describe the ongoing operations of the College, the unique information needs of top management dictated somewhat different perspectives on that information:

- Trend displays rather than point-in-time reporting.
- Insights into relationships, performance standards, ratios, and operating statistics, requiring combining data from several sources.
- Flexibility to display information in varying configurations and for diverse purposes.

Several improvements were added during the upgrading of the College's computing capability that, when combined, made possible a management information reporting system that could support executive management's requirements. These included:

- The capability to either automatically extract summary data from the database and store it in data files for on-line access or, where necessary, to build data files manually.
- The acquisition of a powerful modeling package that could access these files, incorporating data file manipulation and offering complete report format flexibility.
- The systematic structuring of the institution's operational data

to facilitate analysis by organization, by program, fund, revenue and expenditure categories.

The following are the key steps that were taken in developing the Executive Data Book:

- Assigned organization units with functional responsibility for specific data to build and maintain datafiles to support the special information requirements of the Executive Data Book. This approach was appealing because it is much easier to simply update a data file than to manually produce a report as well.
- Assigned organization units with executive reporting responsibility to develop report formats that could be used by IFPS to periodically produce the desired reports by drawing on the available data files.
- Used IFPS to make the necessary row and column calculations as well as to print plot points of trend data. The report formats stored in memory could then be used to automatically produce the desired reports using a letter-quality printer. This would eliminate the need for manual typing and improve the accuracy of the reports.
- Assigned the Office of Budget and Management Studies to provide overall coordination ensuring compatibility among applications and availability of needed data elements and reports.

AUTOMATING THE CREATION OF SUMMARY DATA FILES

Although the computer system upgrading provided summary level hard copy reports, the same summary level data was not available in on-line data files for access by IFPS to create the desired executive level reports. The next step, therefore, required the Computer Center to program a few special reports that would generate data files with key summary data rather than the usual hard copy reports.

Automated data files are currently operating or planned for each of the following modules:

- Budget Preparation--Provides prior year actual, current year budget, and next year's request for each of some 400 organization units.
- Financial Accounting--Provides original budget, current budget, current month expenditures, year-to-date expenditures, and encumbrances for each organization unit.
- Payroll/Personnel/Position Control--Provides current budget and current actual for each employee category and for each organization unit; contains full-time equivalent as well as salary numbers.
- Student Information--Provides budgeted enrollment, actual enrollment, budgeted faculty, and actual faculty for each discipline and major site.

APPLICATIONS

The information areas that have been incorporated in the Executive Data Book are those that support the annual planning, budget preparation, and budget administration processes. The following provides a brief description of each of these activities:

- Long-Range Financial Projection: IFPS provides a powerful tool in projecting the College's financial budget over the next several years. Revenues, as well as expenditures, are projected with a goal of maintaining a positive fund balance during each of the projected years. This application provides executive management with the opportunities to alter key operating variables, test the results, and finally designate the combination of variables that will represent the best available policy options for the future. The projections and reports resulting from this Long-Range Financial Plan then become a crucial part of the Executive Data Book.

o Resource Allocation: After determining the variables that make up the Long-Range Financial Plan, the expenditure amounts are established for the coming year and allocated among various organization and program units of the College. The Resource Allocation Program used by the College takes advantage of access to data files containing historical expenditure information, current budget plans, as well as major programmatic objectives and organizational analyses--a second key document for the Executive Data Book.

o Enrollment Plan: The College's annual Enrollment Plan for the next fiscal year (developed at the macro level during the long-range projection phase) is translated into more detailed allocations by quarter, by subject area, and by campus. (Cuyahoga Community College has three campuses as well as an extensive off-campus instructional program). The allocation of enrollment to each subject area results in an automatically generated base financial budget for the coming year based on some 25 operating factors unique for each of some 80 subject areas. This self-documenting approach to allocating resources for the principal mission of the College--providing instruction to students--gives top management the opportunity to review the key elements of the allocation. Thus, the consideration of projected enrollment numbers (both College-wide and detailed), planned faculty productivity levels in the context of historical experience, and a review of the values assigned for the key operating factors for each of the 80 subject areas finally results in a set of Executive Budget Guidelines for the instructional programs of the College.

- Position Budgeting: Additional data files are created and made available on-line to give position budget information for each organization unit of the College. These data files contain detail for each employee type, for total salary costs as well as total full-time equivalent employee numbers. Two separate data files are maintained; one for current employees, another for vacant positions. Using IFPS to add these two data files together results, of course, in the total number of budgeted positions or total amount of budgeted salary for a given fiscal year. During the budget preparation phase, executive management can facilitate examination of the impact of proposed positions by entering them in a separate data file. This provides executive management with the opportunity to keep proposed positions separate during the consideration of the budget while measuring the potential impact (considering long-range financial projections and/or the effect of reallocation of existing internal resources) on the operating base.
- Financial Budget Requests: The Budget Preparation Module provides the capability to enter detailed revenue and expenditure budget requests on-line at each campus site. During the several weeks that financial budget requests are being entered, College executives are provided with summary reports giving the status of budget requests. Budget requests are analyzed both by major

program and major organization unit, as well as compared to amounts provided in the resource allocation and position budgeting plan.

- Budget Administration: Following finalization of the annual budget, the budget detail is transferred in the computer to the Financial Accounting System for use in comparing, on a monthly basis, monthly and year-to-date revenue and expenditure figures. Each month, summarized data files are created to facilitate macro-level organizational and program analysis of current operations. Annually, this information is combined with information extracted from the Student Information System to provide analysis of direct program costs for each subject area, thus facilitating program evaluation and review.

Conclusion

Production of the Executive Data Book has been the culmination of the successful integration of several key elements:

- On-line accessibility to data files created either by the Computer Center or by the user.
- On-line access to a powerful modeling and reporting software package.
- Availability of numerous terminals linked to the host computer to facilitate accessibility to data.

STANFORD'S TERMINALS FOR MANAGERS PROGRAM: TWO YEARS LATER

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OVERVIEW

In August of 1980, Stanford University began a unique experiment in which terminals were placed on each of the desks of one hundred principle university officers, including the president, the vice presidents, university counsel, and other senior directors and managers. Software, which had been specifically designed for neophyte users, was installed. This software and terminal combination provided users with easy access to an electronic messaging network which extended throughout the campus.

By August of 1982, the user population had grown to one thousand users. Not only were the initial one hundred executives still using the system, but other officers, professional staff, managers, administrators, and support staff had also integrated these facilities into their daily work lives. In addition, the number of available management oriented tools had also grown.

These users still had a very easy to use electronic messaging facilitity which connected them to a very large and growing network. And they also had the means to reach or create other databases, as well as the ability to do business calculations, modeling, graphics, and text processing. In short, they had the beginnings of a very fine professional work station facility.

At the same time that the original terminals and supporting software was being installed, a group of faculty researchers were asked to examine and report on the effects of this experiment. This group, with representatives from Engineering Economics, Communications, Education, Psychology, Anthropology, and Business, conducted their reserach during the first year of the system's life and used the original one hundred participants as the sample population. The results of this work are discussed later in this article.

THE EXPERIMENT

The purposes of the original experiment were two: (1) to educate executives and others in information technology and (2) to provide useful management oriented tools for those executives.

The project team understood that most systems running on computers today are oriented toward the operational environment of the institutions. These systems are primarily transaction oriented. The team felt that in order to be successful in providing management oriented tools and education to organizational leaders, the orientation of facilities provided had to be much less transaction based and much more decision based. The team at Stanford defined "decision based" to mean "...the provision of such capabilitity as communications, text, data storage and manipulation, and computation." A choice was made to begin with communications support; electronic messaging was selected as the first major product. The experiment was proposed to the Vice Presidents. They agreed, not only to support the experiment financially, but to provide the necessary role models by actually using the system themselves.

SYSTEM INSTALLATION

The team put as much effort into planning and installing as they did in building and creating the underlying software. A great deal of thought and energy went into handling such issues as system friendliness, training, documentation, and user acceptance.

The software itself was built with extreme user friendliness and helpfulness in mind. An underlying principle was DWIM (Do What I Mean): The Principle of Least Surprise. That is, the system had to act in predictable ways; ways which made sense to end users who were used to particular office functions. An example of this principle is demonstrated by the delete instruction which allows a user to eliminate a message from her/his file. The team understood that that should not mean to delete the message in the typical data processing transaction sense, but rather in the sense of throwing something away in the wastebasket. And that means that the thrown away item needs to be accessible for some period of time after the delete has been used (just as if it were still lying in the wastebasket).

We planned for and provided individual instruction for each of the original participants. A member of the training team would spend up to an hour and a half with each of these individuals showing them how to use the system (on a terminal which was already installed on their desk). Members of the team were always available for later consultation, follow-up instruction, or on-line electronic message consultation.

Documentation is supplied in several forms. The most useful printed document is a very small pocket size card which provides a reminder of all of the basic instructions and commands for using the electronic message system and for getting logged on and off the computer itself. Manuals, of course, are supplied (but rarely used) except in some educational situations.

Probably the useful form of documentation is contained in the system itself. The system includes a full set of on-line tutorials and help. At any point in the operation of the system a user may obtain information about where they are and what needs to be done next.

The team also paid attention to the fact that many of these users, because of their lack of familiarity with terminals and computers would be afraid of either destroying something important or perhaps of looking foolish before others. Our approach in this case was twofold: On the one hand, during the instructional sessions we demonstrated to them that there was very little they could do to hurt anything either intentionally or accidentally. On the other hand, we dealt with their unfamiliarty with the terminals and the keyboards by providing them with electronic games that were located on the central computer itself. We made it very easy for them to reach these games and play them if they wished. The purpose of this, of course, was to allow them to interact with the terminal and keyboard in a totally non-threatening environment. We are fairly certain that this facility was used to some extent at the beginning. It did accomplish what we had intended.

THE ORIGINAL SYSTEM

The original system, which is now called CONTACT/EMS* (it was then called TFM), contains several major components: an Electronic Message System, an Electronic Filing System, a Tickler System and a Text Preparation System.

The Electronic Message System

The Electronic Message System provides a wide variety of options. First of all, one may SEND messages. Included here are such features as carbon copy to one or more recipients, optional printing, default chronological filing, positive notication of message receipt, optional entry into the reminder system, and so on.

One may also BROWSE through incoming messages. This is equivalent to flipping through the contents of an in-basket. Browsing an in-basket provides an ordered list of messages with information like sender name and identifier, day and date and time, and message subject and length.

The system user may, of course, READ messages. Messages may be read individually by selecting specific items or by examining the contents of the in-basket in sequence. After a message has been presented to the system user, s/he may choose to exercise a variety of actions such as: reply, forward, print, file, delete, reminder, and so on.

Another major feature of the Electronic Message System is the ELECTRONIC DIRECTORY. The directory performs several supportive functions. It translates receiver names or three-letter initials into specific computer account identifiers and interactively resolves duplication with the message sender. It provides a "who" function to allow for the lookup of individuals by either initials, name, or computer account identifier. Finally, it supports a "distribution list" function. Any participant who sends messages regularly to groups of system users may define a distribution list. The name of this list may be used in place of entering each receiver's name every time a message is to be sent to that group.

Also, hard-copy OUTPUT options are available as a part of the message system. Hard-copy may be directed to local printing terminals or word processors or to the central printer attached directly to the computer.

The Electronic Filing System

The Electronic Filing System is an important and powerful component of CONTACT/EMS. Any message which is FILED electronically is automatically indexed by the receiver, the sender, the date, and each word in the subject. In addition specific keywords may be added to aid in subsequent retrieval. The RETRIEVAL of messages is accomplished through simple English like expressions in which any index or combination of indices may be used. This is easily accomplished since all of CONTACT/EMS is based upon the SPIRES (TM) Database System.

The Electronic Reminder System

The Electronic Reminder System accepts a message for subsequent AUTOMATIC RETRIEVAL. Any message may be sent to the reminder system with an indication that it is to be brought back to the sender's attention either on a specified date, after some specified number of days has elapsed, or on some day in the next week.

The Text Preparation System

Text preparation is accomplished in a variety of ways. The basic editor for entry of messages is the WYLBUR line editor. Word processors equipped with communications facilities may also be used as entry and message sending devices. In addition, SCRIPT is available for the preparation of long documents. A very high speed laser printer which includes definitions for nearly 100 different print fonts may be used for output at the central facility.

EVALUATION

At the same time that the original software was being installed, a group of faculty members was asked to do an evaluation of the impact of this facility upon users at Stanford. This evaluation team which consisted of faculty from Engineering Economics, Communictions, Education, Anthropology, Business and Psychology, performed their examination during the first year of the system's life. They used two survey instruments as well as system maintained statistics to gather both user opinion and usage information over time. The evaluators were interested in the answers to several fundamental questions:

How Much Is CONTACT/EMS Used?

System usage measurement showed that users were sending 4.5 messages per user per day (users in the upper quartile were sending in the excess of 10 messages per user per day). Interesting enough, user perception was that they were using the system 40% less than actual. And this perception changed over time; by the end of the survey these same users felt they were using it only 66% of actual use. We've assumed that this wide difference between perception and actual use is caused by their own increase in familarity with the facility and tools over time. That is, they no longer notice how much they are actually using this facility.

Users were also asked for their own perception of the relationship between the use of CONTACT/EMS for communicating with their staff and other forms of communication, such as face-to-face contact, telephone, and writing. At 15%, the electronic messaging system is being used as much as half as much as face-to-face contact, the most popular form of communication.

How Is CONTACT/EMS Used?

This question was answered primarily by asking users. Over 90% of the users felt that the CONTACT/EMS was extremely useful for exchanging information, asking questions, generating ideas, exchanging opinions, and generally staying in touch. Only a small percentage felt that it was useful for resolving disagreements, bargaining or negotiating, or getting to know someone.

We also examined the length of messages which were being sent (measured by the number of lines in messages). It turns out that the greatest number of messages are very very short. The average length of messages sent over the system during the evaluation period was 14 lines. But 50% of the messages sent were actually between 6 and 8 lines. This indicates that the bulk of messages are very brief and are probably equivalent to very short, hand-written notes.

Has the Use of CONTACT/EMS Changed User Behavior?

Several statistics do indicate that it has. For example, only 30% of messages sent are ever printed. This is an indication that people are using electronic messaging as a new and distinctly different form of communication. Also, over 26% of the users reported taking terminals home at least once during the evaluation period; in many cases users took terminals home more than once and some have them permanently installed in their homes. About 10% have carried and used portable terminals while traveling. Users have also reported that their communication networks have expanded through the use of CONTACT/EMS. Over 44% reported sending messages to people they have never communicated with before and 57% reported receiving messages from people they have never communicated with before.

Most significantly, the users of CONTACT/EMS have reported that the number of calls received and the amount of paperwork received has been reduced. Furthermore, they feel that both the quantity and quality of their work has increased all as of a result of using this tool.

How Satisfied Are Users of CONTACT/EMS?

This is the question which summarizes all the others. It is answered in several ways. First of all, an examination of the number of users on the system showes an amazing rate of growth. Beginning with no use in August of 1980, system usage has grown to over 1000 by August of 1982.

From a more anecdotal point of view, users report that they can work better and faster. They tell us that the use of CONTACT/EMS saves them time; they are able to regulate the flow of communication to a much greater degree than before, and that much less "falls through the cracks".

A different kind of satisfaction is demonstrated by users who have begun to use the system independantly to set up their own communication networks. For example, the Governmental Affairs Office at Stanford has sponsored a network which stretches across the United States and links major University Associations, such as AAU and COFHE, with nearly 50 other institutions. In another situation, the Cash Management Office is using CONTACT/EMS to communicate with a bank in New York on a regular basis.

INFORMATION MANAGEMENT RESOURCES

The evaluation took place during the initial year of the system's installation and concentrated on the impact of a computer-based electronic messaging system within the Stanford community. During that same period, and since, the project team has been working with user advisors to find the most appropriate ways to extend these facilities into a true, decision-based, professional work station system. Given the definition of decision-based which includes communiations, text processing, data storage and manipulation, and computation, the team knew that it was important to provide additional kinds of facilities. While this work is an ongoing project, some capability in each of of these areas is now provided. It is now possible to not only reach an electronic messaging facility and the other users on that network, but a variety of other management augmentation and office information tools.

For example, additional capability has been provided to assist in text preparation. Simple, easy to use programs can be called upon which will aid users in the preparation of memos, letters, and reports. Also, a very comprehensive business calculator has been provided. This calculator provides most of the capability of a hand-held financial calculator but enables users to see what has been entered and to make changes either for the purposes of correction or for modeling particular situations.

The electronic filing capability is extended both by showing users how to use and organize their message files to file other personal business related information. A facility which helps to create an individual file, such as a name and address list has also been supplied. Users have also been given easier ways to access files and databases which contain information of general utility (in the sense of information about particular facilities, special events, etc.). Of course, these same terminals can be used to access information from specific application databases (but only when the particular user has been authorized for such access by the owner of the database). Local office databases and, in some cases, entire subsystems have been created to support particular needs within local offices. A way to perform particular budget and other financial evaluation for grants, contracts and operating budgets has been provided. A system for keeping track of personal leave time is also available to offices.

The team is beginning to evaluate various ways to provide graphic facilities for both analytical and presentation purposes. Finally, consultation on, and in some cases assistance in building, modeling systems is being provided for offices that request such support.

We are in the process of building an electronic conferencing capability to allow groups of users to jointly communicate about specific organized subjects (e.g., a building project). We are also looking toward the ability to support a meeting scheduling and room scheduling capability. Stanford is also working with EDUNET on the inter-campus MAILNET. And we are in the process of building such links amongst the many computers on our own campus.

This program has been extremely successful; it is accomplishing its objectives. The users of the system have come a long way in understanding information systems and information technology. They like the facilities and have integrated them into their daily work environments. It is the users who are telling us how they are able to increase their own effectiveness and it is the users who are, in the final analysis, the final judges of such facilites.

DOCUMENTATION AS A MANAGEMENT TOOL

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The responsibility for documentation of computer systems has been a point of contention between users and programmers (providers) at Marist College. Users expect providers to supply documentation when systems are delivered; however, due to the small programming staff and excelerated pace of implementation, documentation is not high on the programmer's list of priorities. This situation has resulted in high levels of frustration for staff and managers in major operational areas, and has had an impact on the productivity of providers as well. In an effort to resolve this problem, users and providers have reached an agreement whereby users document their systems, and providers review the documentation for accuracy.

This paper describes the experience that one college had in using this approach and notes the impact the results have had on users, managers, and providers of administrative systems.

INTRODUCTION

The information resources of a College or University are among its most valuable assets. With a declining student pool, and increasing costs and competition, the institutions that survive in the 80's will be those that manage information as a major resource.

A common method of managing information (the product of data analysis and synthesis), is through computerized systems. A requirement for successful implementation of computer systems is user involvement with and successful utilization of the system. Ideally, when systems are delivered to users, providers (programmers) will also deliver documentation for the system.

Documentation is human readable material that supplements a computer readable program. Documentation should accurately represent what the system does, and how the system can be used. At a minimum, documentation should consist of a users manual and an operators manual. A user's manual describes in user language all the information needed by the user to successfully use a program. An operator's manual is directed solely at the execution of the software product on the computer.

Despite the fact that documentation is essential to the understanding of a software product, this activity falls low on the priority schedule of many providers, particularly when a system is written and implemented "in house". Of the 8-10 administrative systems that have been implemented in the last 2 years at Marist College, none have been documented by programmers for users.

This paper describes the effects that "no documentation" had on the College, and a viable solution to this dilemma. It also suggests that a user produced documentation effort can be a tool to better manage the information resources of the College.

BACKGROUND INFORMATION

In order to fully understand this approach to documentation, it is necessary to recognize the environment in which it functions. The following information about Marist College is intended to provide a basis of comparison for other institutions that may be interested in utilizing such an approach.

The College

Marist College is an independent co-educational liberal arts College located on the Hudson River in Poughkeepsie, New York, midway between New York City and Albany. The institution was founded by the Marist Brothers and chartered as a four year College in 1946. In 1969, ownership of the College was transferred to the Marist College Educational Corporation with an independent Board of Trustees.

Marist is tuition intensive with a large proportion of revenue provided by sponsored programs. The 100 acre campus accomodates 2100 full-time equivalent (FTE) undergraduate students and 100 FTE graduate students.

A strong working relationship between students and faculty is an important aspect of the learning process at Marist. The College's programs emphasize liberal arts with a professional orientation.

The Technical Environment

The Computer Center organizationally falls within the aegis of the Vice President for Administration and Finance. The Center provides all computer support for both administrative and academic users at the College; there are also ten external organizations using the Marist system. Users are served by an IBM 4341 operating under VM and MUSIC. One hundred and ten ports provide interactive access to the system.

The current Computer Center staff consists of (in full-time equivalents), one Director, one Associate Director, 1.6 Systems Programmers, two Applications Programmers, one Operations Manager, one night Operator, .4 Academic Coordinator, one Secretary, 1.8 Student Programmers, and one Student Clerical assistant. APL is the primary programming language.

User Organization

A structure consisting of two user committees, both of which are chaired by the Director of Institutional Research, currently exists at the College.

The Information Management Committee consists of middle managers who are Directors of major administrative functions. The primary purpose of this committee is to provide a control structure for distribution of computer resources to and implementation of computer systems in the administrative areas of the College. The committee also provides a forum for communication between Directors of major operational areas, and aims to facilitate good information management practices at the College.

The Operations Committee consists of operational staff and office managers. The purpose of this committee is to clarify and coordinate procedures to manage the data gathering and daily operational activities of the administrative offices.

THE PROBLEM

Both users and providers were effected by the chronic lack of system documentation for users. In many areas of high turnover, the manager was the only staff member who was aware of the impact the computer had on operations in the area and was often only remotely aware of the specifics of using the system. The small programming staff was often unwilling or unable to spend precious time training new staff to utilize systems or to repeatedly answer questions from continuing staff on details of how to utilize seldom used applications. The result was a high level of frustration and a low level of productivity.

THE SOLUTION

Members of the Operations Committee were particularly concerned about the lack of documentation of systems, probably due to the fact that they were the most intimately involved in operating the systems. In an effort to resolve the problem, members of this committee and their colleagues agreed to document their own systems with assistance from programmers. The project has been coordinated and clerical support provided by the Office of Institutional Research.

The activity is an ongoing one; it has not yet been completed. Aside from the production of a manual, the purpose of this activity is to insure that users are aware of all options in their system, and more importantly, how and when to use them.

A simple outline (see Appendix A) was developed as a guide for users when "doing" their documentation. Once a user completes the fundamentals, the documentation is sent to the Office of Institutional Research, where it is entered into the word processing system and reviewed for completeness. If necessary, the Director of Institutional Research works with the users to refine the format of the documentation, and to further clarify explanations.

Documentation is then sent to the programmer representative for the area where it is reviewed for accuracy. If necessary, the programmer works with the user to consolidate or streamline the menu, fill in gaps in function by writing new application code, and explain or clarify how to use specific features.

RESULTS

The project has allowed the user and provider to look together to see if what the system does is appropriate to the needs of the user. In essence, the user's documentation is an evaluation of the effectiveness of the computer in his/her area.

The overall quality of communication between users and technicians has been enhanced by the project. Frantic calls to the Computer Center have diminished. Management has benefited from the project in that users are not only documenting their systems, but are documenting and clarifying both inter and intra office policies and procedures as well. Users, both at the operational and management levels have taken an interest in enhancing their systems, and in integrating their systems with those in related areas.

DISCUSSION

Several questions come to mind when one is giving consideration to the mounting of a documentation effort.

How should documentation be originated and maintained?

There are a variety of methods for doing documentation. Programmers may provide documentation upon delivery of a system to a user. An organization may engage an external consultant or writer to document systems. Or, as suggested in this paper, users may write their own documentation. Each method has its advantages and disadvantages. Institutions must examine the unique characteristics of their situation and choose a method accordingly.

The method an institution chooses to use to originate documentation will probably determine who is responsible for maintaining the documentation. The importance of maintaining the documentation cannot be overemphasized. Obsolete documentation can be more confusing to a user than no documentation at all.

What makes documentation valuable?

Documentation is valuable to the extent it is used and understood. User documentation should be written in user language. It should be simple to follow and easy for someone who has never used the system to understand.

One of the most valuable aspects of documentation as discovered through utilization of the approach suggested in this paper was the process of "doing" documentation. A user's ability to explain an operation often indicates how well that operation is understood. Informed users can contribute more to an organization than can uninformed users, particularly in the area of information management.

How can we motivate users to take on such a project?

One of the first steps toward resolution of a problem is the agreement of parties to be responsible for it. Both users and providers at Marist agreed that a problem existed. Neither group wanted to take the time to address it. Both groups however, were ultimately able to get beyond this consideration in the interest of the College as a whole. Several elements were important in facilitating the process. Both users and providers agreed that

1. user documentation and user training were inadequate.
2. programmer skills could best be used in the coding and implementation of systems.
3. users were the experts in knowing how well they understood their system and how well their system supported operations in their area.
4. a division of labor was necessary. Each user area was responsible for the documentation of its system.

Programmers were responsible for documentation of general system functions (sign on, batch submit, generalized reporter, etc.).

5. the documentation effort would be coordinated and clerical support provided by a neutral office (neither user nor provider).

SUMMARY AND CONCLUSIONS

This paper has described one College's experience in moving towards resolution of a problem experienced in many institutions who choose to implement their own systems. Perhaps a statement by Richard L. Mann sums up the spirit of this effort:

> "No matter how sophisticated the hardware, how capable the staff, how inexhaustible the financial resources or how willing the users, the effective use of computers in higher education ultimately depends on how well the users and providers understand the constraints and problems that they face and how they deal with their productive resolution."

APPENDIX A
Outline for User Documentation

I. Operating Instructions (PROVIDERS)

- A. Signing On
- B. Purging a file
- C. Saving a problem
- D. Changing the password (if applies)
- E. Printing a file

II. Explanation of User Applications Available (USERS)

- A. Menu options - what you can do
  1. What is the purpose of each option?
     - a. Identify the impact that the option has on data (eg. add new records, transactions, journal entries; edits; deletes records; updates a field; no impact on data - is a report).
     - b. If the option does have an impact on data, identify the source document used to justify data modification (eg. buffers; other files; terminal entry from specific document).
  2. What are the policies/procedures affecting the use of each option?
     - a. Who can use the option?
     - b. When is the option used (deadlines; certain situations; etc.)?
     - c. What impact does this option have on other files (yours and/or those of other offices)?
     - d. What precedes and/or follows this option chronologically?
     - e. How is output from this option handled (where does it go, is it secure, etc.)?
     - f. What audit for accuracy should be checked (ie. how do you know the option worked)? What if there is an error (ie. it didn't work)?
  3. Specifically explain how to use each option. This includes:
     - a. Questions asked when using the option (eg. semester/year)?
     - b. Possible alternative answers to each question.
     - c. The format for entering answers.

d. The method/methods for generating output from each option (from a terminal, from batch, etc.).
e. Examples as necessary.

B. Field Data
1. Identify each field description as it appears on the screen
2. Identify the field number, name, length, type (character or numeric)
3. Describe any input specifications for each field
4. Identify individual value descriptions for each field
    a. Identify the source for each code
    b. Indicate possible codes and an explanation of each

III. Other useful information (PROVIDERS)

A. Memo facility

B. Batch facility

C. 1000 Reporter

D. Miscellaneous - other Computer Center options (i.e. forms, command language, etc.)

E. Procedures Manual

An Investigation into Combined Versus Separate Academic/Administrative Information Systems

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An Investigation into Combined Versus Separate Academic/Administrative Information Systems

This is an investigation into combined versus separate academic/administrative information systems of various colleges and universities. An overall profile of some major trends in organization structure is provided along with individual profiles of college and university organization and hardware. The presentation involves a panel discussion by representatives from each of four institutions; two representatives of combined systems and two representatives of separate systems. Each briefly describes that system and is open to discussion with the audience.

This is an investigation into combined versus separate academic/administrative information systems. An overall profile of some major trends in information systems is provided along with individual profiles of systems organization and hardware. The overall profile is provided by the CAUSE organization (the Professional Association for Development, Use, and Management of Information Systems in Higher Education) in Charles R. Thomas' Administrative Information Systems: The 1980 Profile. Individual profiles are from a survey of administrative officers at the individual institutions.

Thomas surveyed 350 colleges and universities to determine current trends in system organization and reporting. Pertaining to combined versus separate systems, the data by institutional type suggest that the complexity of the institution affects the organizational structure chosen. The larger the institution, the more likely that administrative computing will be handled in a separate installation. Separate installations are more likely to report to the administrative vice president, or to another officer below the vice presidential level, than are the combined academic/administrative installations. Combined installations report to the business vice president more often than do separate systems.

For the current paper, a random survey of twenty institutions with combined or separate academic/administrative systems was performed and some variation in administrative information systems reporting was found. Of the institutions with separate academic/administrative systems: three report to a vice president for finance, two to an administrative vice president and one to an institutional research director. Of the institutions with combined academic/administrative systems: one reports to the dean of planning and research; one to the vice president for planning; one to the vice president for research; three to administrative vice presidents; two to a vice president for finance; two to an academic vice president; one to an executive committee; and, three to another executive officer.

Of the twenty institutions surveyed, four are presented here in detail. These include two institutes with combined academic/administrative information systems, the College of DuPage, and Oklahoma State University, and two institutes with separate academic/administrative information systems, the University of Iowa and the University of Colorado.

College of DuPage

All computing services at the College of DuPage are provided by, and coordinated through, the Computer Services department. This includes all administrative as well as academic functions, the only exception being computer science curriculum development and instruction which is, of course, the responsibility of the faculty. The Computer Services department is run by a director who reports to the Vice President of Planning and Information (Figure 1). There are four managers who report to the director. Each manager is in charge of one area of service; administrative, academic, technical, or operations. While the director is ultimately responsible for the type of equipment or systems installed, the managers research and make recommendations to the director concerning hardware and software acquisition and use.

There are three college committees which advise the Director of Computer services on matters concerning computer usage. These are the Administrative Systems Users Advisory Committee (ASUAC), the Academic Systems Users Advisory Committee (ACUAC) and the Computer Servies Management Committee (CSMC). ASUAC and ACUAC membership is composed of users from those areas, and the associated manager. The CSMC members are the college president, vice presidents and provosts. This particular organization has been in effect since the fall of 1979, and so far has proved beneficial to the college. With one central department serving as a clearing house for all computing functions, coordination is insured and communications between areas is facilitated. Meetings are held weekly between the managers and the director to exchange ideas, settle problems, devise schedules and keep one another up to date on the latest developments within and without the Computer Services area.

This organizational structure has worked well up to this time. No area is emphasized to the detriment of the other areas. As additional areas of responsibility are defined, e.g. the automated office, local networking; additional managers can be added without sacrificing coordination and communication. The managerial concept seems to provide the flexibility to meet the challenge of the changing environment.

Oklahoma State University

In 1968, all computing and data processing at Oklahoma State University was organized into one office called University Computing and Information Systems. This office is headed by a director which reports to the Vice President for Academic Affairs and Research with secondary responsibility to the Vice President for Business and Finance (Figure 2). The office of University Computing and Information Systems has three departments, each headed by a director, that reports to this office. The three departments are University Computer Center, Administration System Development, and Institutional Research.

The University Computer Center provides computing facilities for instruction, research, and administration; provides programming and consulting for instruction and research users; and education and training for all users of the Center. The Administrative System Development department coordinates all systems development for the central administrative offices of the university; maintains the data processing systems for university operations; and schedules administrative data processing activities with the University Computer Center. The Institutional Research department conducts special analytical studies for the administration; maintains and distributes basic management reports; conducts continuing analytical studies of University operations; and supports planning for the entire university. This department is a user of data processing and computing services.

The primary advantage of the combined organization structure is economics. It has been well documented such a structure has significant savings in staff and equipment/software as compared to two separate computing facilities. Other advantages are better coordination between academic and administrative uses of computing without having equipment such as terminals dedicated to a certain processor; less competition for university resources to support two separate centers; better utilization of computer resources leveling out peaks and valleys as academic and administrative computing often occur at different times; and having one individual at the top management level responsible for computing provides better opportunities for computing and data processing activities to serve the overall objectives and goals of the university.

University of Iowa

The University of Iowa is served by separate administrative and academic computing facilities. There is a third major center supporting the patient related information processing functions of the University Hospitals and Clinics. The three centers are separately staffed and equipped. There have been no formal ties between the centers and they are not physically interconnected. Coordination has been informal and has occurred primarily at the upper management level. Until recently the centers were separately administered, each reporting to a different University vice president. In August of this year the University created an Office of Information Technology which now has responsibility for both administrative and academic computing.

The organizational structure as it existed prior to August of this year has been essentially the same with regard to computing since the late 1950s (Figure 3). It is a structure which overall has worked to the benefit of the University. The chief advantage of the separation has been the lack of competition for resources except at the highest administrative levels of the University where each constituency has an advocate. This has in turn eliminated the need to make administrative versus academic compromises at the operational level. Each center has been able to pursue a course suited to the best interests of its user community. Choices in operating philosophy, staffing, and equipment have been made with little concern for their impact on a second, dissimilar group of users.

What has evolved are two vigorous, progressive, and adequately funded facilities which are in many ways similar but have some significant differences. Both are end user oriented, having a strong sense of a service mission to their respective user communities. Both centers are on a chargeback system and both operate in a predominently online environment. The administrative center is a single vendor, closed access shop with a strong applications development staff. All end user application software development is the responsibility of the administrative center staff. Most applications software is internally developed rather than acquired from outside sources. The academic center is an open access, multivendor shop with a small applications development capability.

Strong emphasis is placed upon high quality, easy to use, general purpose software which is leased or purchased from outside sources. Most end user applications development is the responsibility of the user.

The primary weakness in the separate facilities approach as implemented at Iowa is that while the base of management information in the data processing system has grown and the level of awareness regarding its potential value has increased, its utility to the academic community is constrained. Conversely tools in the academic center which increasingly have value to the administrative community are not easily accessible to that community. The only mode of data exchange, magnetic tape, is cumbersome and untimely. Convenient access to both computing facilities now requires redundant equipment (i.e. terminals). The fact that there have been no formal ties or coordination of effort has resulted in some inefficiencies. The exchange of information and experience at the middle and lower levels of the organizations have been negligible. There is an obvious redundancy in the independent data communications networks serving the three facilities.

In August of this year the University of Iowa created the Office of Information Technology. The office is the joint responsibility of the Vice President for Finance and University Services and the Vice President for Educational Development and Research. The director of this office has been given responsibility for both the administrative and academic computing units as well as a planning, advisory, and coordinating role in the application of information technology and communication. The creation of this office is the result of a heightened awareness of information as a valuable resource and the role of technology in its exploitation. Its creation specifically addresses the weaknesses previously identified hopefully without adversely affecting the strengths that the structure has evidenced.

University of Colorado

The University of Colorado comprises 16 schools and colleges on 4 campuses. The original and central administrative offices are located in Boulder. The Health Sciences Center, including the schools of Medicine, Nursing, and Dentistry, and two teaching hospitals, is located in Denver. The university also operates urban campuses in Denver and Colorado Springs.

Each campus has a chancellor who is the chief academic and administrative officer of the campus. Each chancellor is responsible to the president of the university for the conduct of affairs on the campus in conformance with the policies of the Board of Regents. Among the myriad of other duties, each chancellor has reporting to him at least one director of computing. The Health Sciences Center has two, one for academic computing, and one for health care-related administrative computing.

The university operates two central computing facilities. The University Computing Center (UCC), located in Boulder, is responsible for providing research and instructional computing support to all campuses. The Consolidated Administrative Data Processing Center, also located in Boulder is responsible for providing administrative computing support to all campuses and the central administration. An unusual organizational aspect of this arrangement is the fact that the central university academic computing facility reports to the chancellor of the Boulder campus, while the director of the administrative facility reports to the University Director of Management Systems who reports to a university vice president (Figure 4).

The separate central computing facilities have continued since the early days, however, as is typical at most institutions, the organization is reviewed every 3 or 4 years to see if economies of scale can be achieved or whether some significant, if not dramatic, improvement in computing support can be realized. All such deliberations have, so far, led to the conclusion that, although computing needed to be enhanced and improved, it was not clear that reorganization would provide enough improvement to justify the risks (real or imagined) of reorganization. In addition, the concern that the competition for resources would develop when resources become scarce has been a strong deterrent to combining computers or facilities.

There are many advantages to the current arrangement. Each function and facility has the full attention of its management and administrative personnel. There is no confusion over the primary mission of each facility, and priority-setting occurs within each major type of activity; administrative or academic. Each facility is configured (with hardware and software) and staffed to provide optimum service to the type of user which it supports.

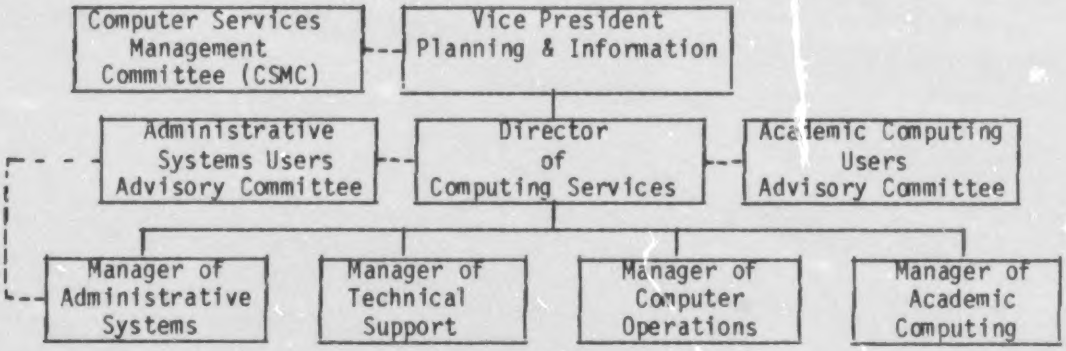
The administrative facility is located in the heart of the largest campus which is also the largest use of administrative computing; communication facilites and costs are minimized. Some aspects of data and access security are reduced. A greater variety of equipment and software is available in the institution than would have been the case if a single computer system had been dedicated to providing all computing support.

There are some disadvantages to the current arrangement. Communication between the two facilities is not as easy as it could be, either between computers or between people. Competition may occur over available state and institutional funds as it might over computing capacity in a combined facility. Many users must cope with multiple operating systems, communication protocols, programming and inquiry languages, etc. Opportunities to achieve economies from sharing operators, systems programmers, and other support staff may be restricted.

FIGURE 1

College of Dupage Information System (June 1982)

Organization


Computer Services Management Committee (CSMC)
Vice President Planning & Information
Administrative Systems Users Advisory Committee
Director of Computing Services
Academic Computing Users Advisory Committee
Manager of Administrative Systems
Manager of Technical Support
Manager of Computer Operations
Manager of Academic Computing

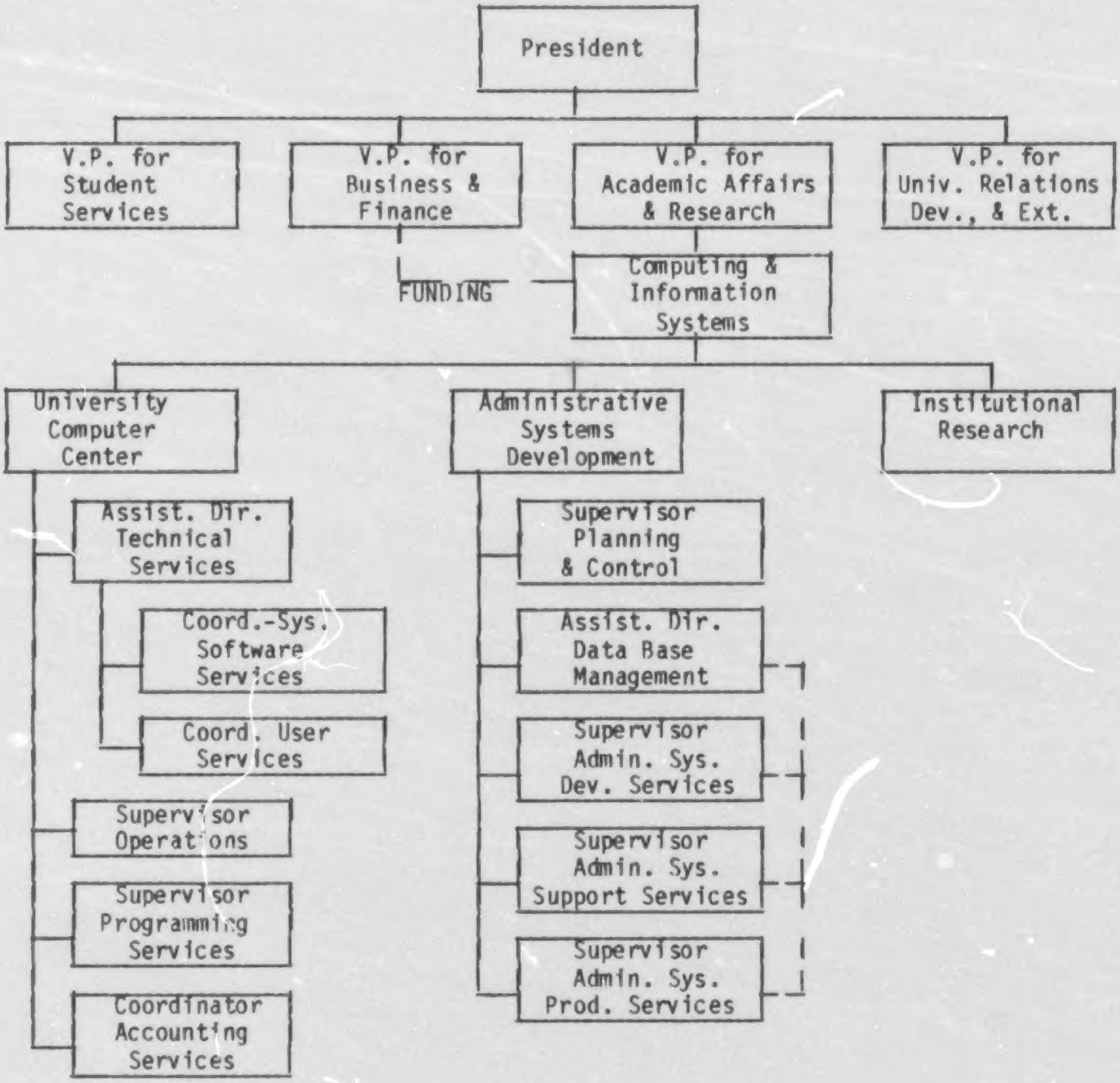
Hardware

IBM 4341 - Administrative Systems
Hewlett Parkard HP3000 - Academic Computing
DEC 11/34 - Learning Resource Center

FIGURE 2

Oklahoma State University Information System (July 1982)

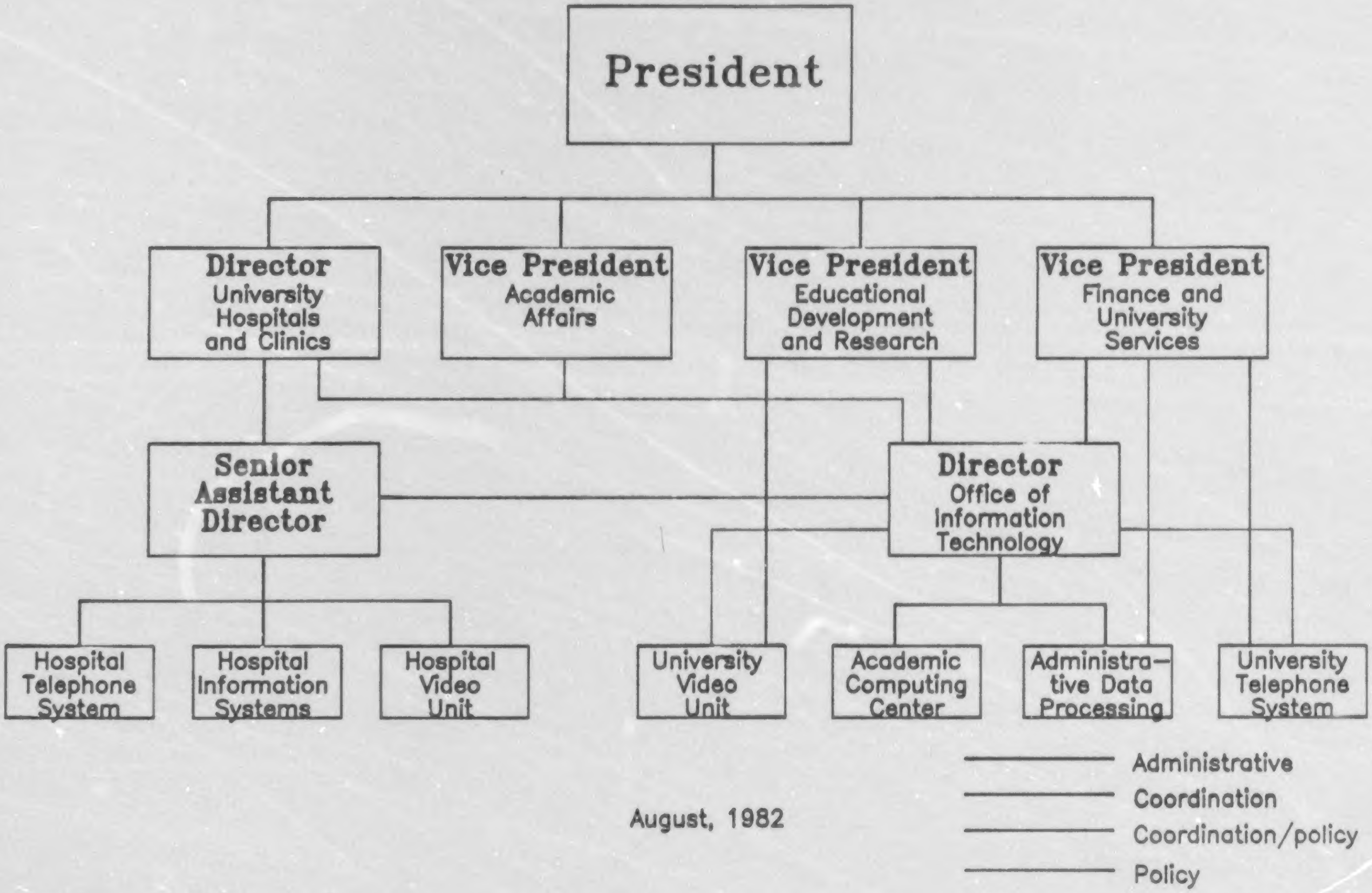
Organization


President
V.P. for Student Services
V.P. for Business & Finance
V.P. for Academic Affairs & Research
V.P. for Univ. Relations Dev., & Ext.
FUNDING
Computing & Information Systems
University Computer Center
Administrative Systems Development
Institutional Research
Assist. Dir. Technical Services
Coord.-Sys. Software Services
Coord. User Services
Supervisor Operations
Supervisor Programming Services
Coordinator Accounting Services
Supervisor Planning & Control
Assist. Dir. Data Base Management
Supervisor Admin. Sys. Dev. Services
Supervisor Admin. Sys. Support Services
Supervisor Admin. Sys. Prod. Services

Hardware

IBM 370/168 Model 3 - Academic and Administrative Systems
DEC VAX 11/780 - Academic Interactive System
Three (3) IBM series/1 } Administrative System
One (1) IBM 8100 Distributed Systems }

University of Iowa



President

Director University Hospitals and Clinics

Vice President Academic Affairs

Vice President Educational Development and Research

Vice President Finance and University Services

Senior Assistant Director

Director Office of Information Technology

Hospital Telephone System

Hospital Information Systems

Hospital Video Unit

University Video Unit

Academic Computing Center

Administrative Data Processing

University Telephone System

Administrative

Coordination

Coordination/policy

Policy

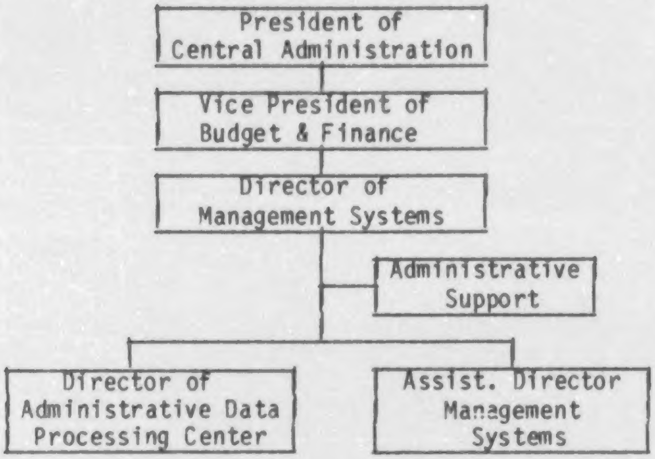
August, 1982

FIGURE 4

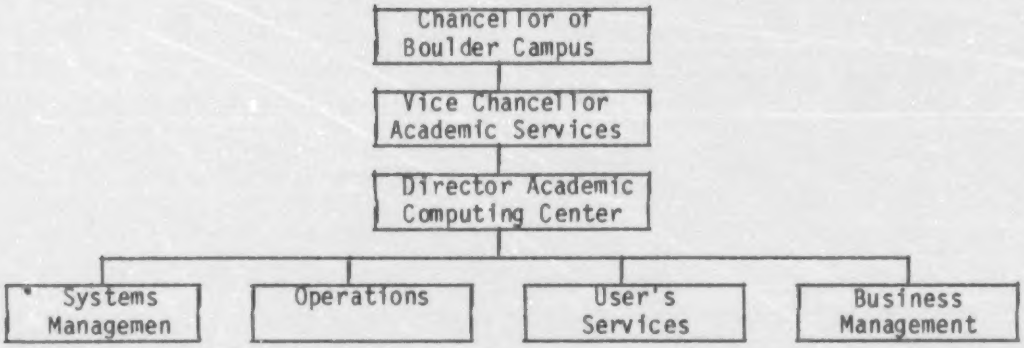
University of Colorado Information System (August 1982)

Organization

ADMINISTRATIVE SYSTEM


President of Central Administration
Vice President of Budget & Finance
Director of Management Systems
Administrative Support
Director of Administrative Data Processing Center
Assist. Director Management Systems

ACADEMIC SYSTEM


Chancellor of Boulder Campus
Vice Chancellor Academic Services
Director Academic Computing Center
Systems Managemen
Operations
User's Services
Business Management

Hardware

CYBER 170/720
DEC VAX 850/780 —Central Academic Computing
IBM 370/3031 - Central Administrative Data Processing
IBM 370/148 - Health Sciences Center Administrative
TANDOM - Health Sciences Center Academic
DEC VAX 780, DEC 11/70 - Colorado Springs Campus
PRIME 750 - Denver Campus Academic

STUDENT FLOW AND CURRICULUM MATRIX

by

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CONCEPTUAL OVERVIEW

EXECUTIVE SUMMARY

The analytic system described in this document is designed to allow academic administrators to address questions of the following type:

1. What is the likely departmental workload that will occur next autumn for upper division undergraduate courses in English?
2. What is the probability that a junior majoring in Accounting this fall will be a senior in Accounting next fall? What is the probability of that student shifting to Marketing?
3. What are the comparative retention/attrition rates for students of various majors?
4. What is the credit hour impact of advanced undergraduate Physics majors on the Math Department as well as on other departments?

The system consists of three steps. The first step, Student Flow Calculation, computes the relationship of enrollments by major and student level from one year to another. This calculation utilizes historical enrollment trends and a simple flow technique to develop the probability of a student with a given major and student level being in another major/student level in the next year.

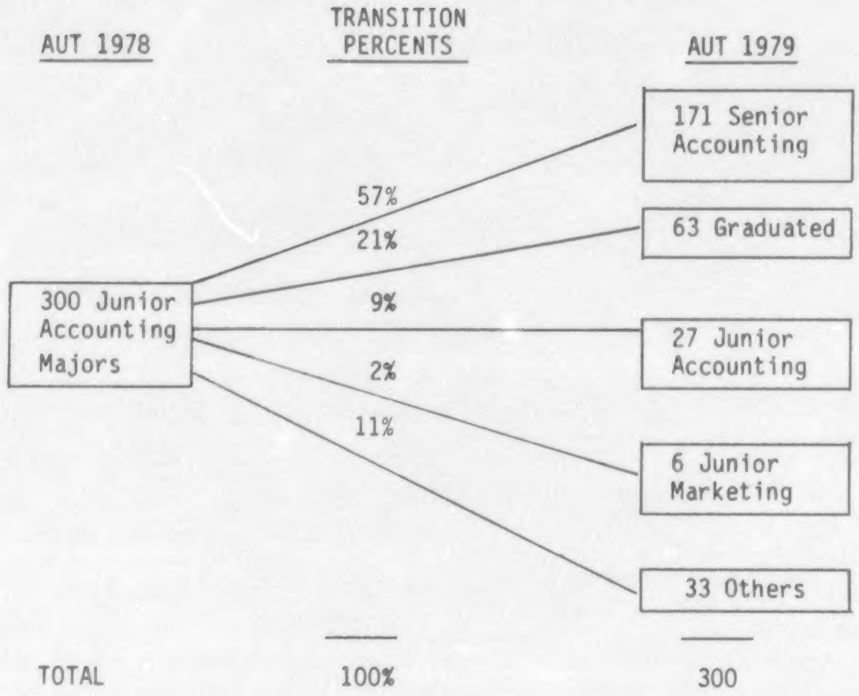
The second step is the construction of a historical Curriculum Matrix (CM). This matrix describes, in credit hours, the relationship between students majoring in various degree programs and the departments from which they draw instructional services.

The third and final step of the system combines the outputs of the first two steps to produce Departmental Workload Forecasts. The remainder of this Executive Summary discusses each component of the system.

A. STUDENT FLOW CALCULATION

The student flow calculation computes the percentage of students of a given major and rank in one period who end up with a given major and rank in a subsequent period. For example, what percentage of junior Accounting majors in Autumn Quarter 1978, were enrolled as senior Accounting majors in Autumn Quarter 1979; what percentage graduated; what percentage remained junior accounting majors, etc.? Figure 1 is a display of student flow transitions.

FIGURE 1


AUT 1978
TRANSITION PERCENTS
AUT 1979
171 Senior Accounting
57%
21%
63 Graduated
300 Junior Accounting Majors
9%
27 Junior Accounting
2%
11%
6 Junior Marketing
33 Others
TOTAL
100%
300

B. CURRICULUM MATRIX:

A Curriculum Matrix can be one of two types of reports. The first report is Credit Hours Taken, which is organized by student major. It shows the average number of credit hours taken by each student major from each instructional department. The second report is Credit Hours Taught which is organized by department and shows the average number of credit hours taught by each department to each student major. Figure 2 is a simplified Credit Hours Taken Curriculum Matrix:

FIGURE 2

CURRICULUM MATRIX

Average Number of Credit Hours Taken by Majors in:

	HIST	ENGLISH	MATH
PSYCH	3.5	1.0	1.0
HIST	6.0	3.0	3.0
ENGL	3.0	6.0	3.0
MATH	2.5	3.0	6.0
TOTAL	15.0	13.0	13.0

This Curriculum Matrix shows that History Majors take, on the average, 3.5 credit hours from the Psychology Department; 6.0 credit hours from the History Department; 3.0 credit hours from the English Department and 2.5 credit hours from the Math Department.

C. DEPARTMENTAL WORKLOADS:

Projection of departmental workloads is obtained by first projecting enrollments in the various student major categories. This projection can be made by using the student flow transitions computed in Step A. These projected enrollment data are then multiplied by the proper curriculum matrix elements to give projected departmental workloads. For example, suppose the student flow calculations are used to project that the University will enroll 300 History majors, 200 English majors and 100 Math majors. Multiplying the columns of the sample curriculum matrix, displayed in Figure 2 by 300, 200, and 100, respectively, produces the workload matrix shown in Figure 3.

FIGURE 3

PROJECTED WORKLOAD MATRIX

DEPT \ MAJOR	HIST	ENGLISH	MATH	TOTAL PROJECTED DEPT. WORKLOAD
PSYCH	1,050	200	100	1,350
HIST	1,800	600	300	2,700
ENGL	900	1,200	300	2,400
MATH	750	600	600	1,950
TOTAL	4,500	2,600	1,300	8,400

Thus, the projected total departmental workload, based on the sample historical curriculum matrix in Figures 2 and sample projected student majors of 300, 200, and 100 headcount students in History, English and Math respectively, produces 1,350 credit hours in the Psychology Department. (3.5 x 300 + 1.0 x 200 + 1.0 x 100). Similar calculations produce projected workload of 2,700 credit hours in the History Department; 2,400 credit hours in the English Department; and 1,950 credit hours in the Math Department. Projected total University workload is 8,400 student credit hours.

D. USES OF THE DATA:

The Credit Hours Taken Report (See Figures 2, and 8) of the curriculum matrix can be used by a dean or department chairperson to determine in which departments, and at what course levels his/her majors are taking courses. Are upper division students taking an unexpectedly large number of credit hours in lower division courses? Are students taking a large number of credit hours in unexpected disciplines? If so, perhaps the department or college is not offering a broad enough array of courses. The Curriculum Matrix can be used to estimate the effect of planned curricular changes on departments. For example, the effect on the Foreign Languages Department of a new language requirement for Physics majors can be estimated. Likewise, the effect on the Foreign Languages Department of expected increases in headcount Engineering majors or decreases in Education majors can be determined.

A Credit Hours Taught Report (See Figure 9) can be used to determine what majors and what levels of students are taking courses offered by a department. Typical questions include: Are an unexpectedly large number of lower division students taking upper division courses or vice versa? Are students of unexpected majors taking credit hours taught by the departments? Are non-majors taking courses intended primarily or exclusively for majors? Different course consumption patterns of male versus female students can be determined by producing the curriculum matrix first with only male students included and then with only female students. In fact, any variable may be substituted for the student major/student level, department/course level categories traditionally shown in the curriculum matrix.

The Transition Probabilities (See Figure 6) from the student flow calculation have substantial utility also. For example, by running the student flow calculation "backwards" a retention study can be conducted. A backwards run is constructed by designating the more recent term, the "from" term, and the more distant term the "to" term. In this configuration students who are not enrolled in the more recent term, but who were enrolled in the more distant term are defined as exiting students. In this mode one can determine which student majors and student levels within student majors have higher or lower attrition rates. Transition probabilities for several years can be compared from like term to like term in order to highlight trends in student major changes. For example, if students are switching out of the department's majors into other degree programs, further analysis could be conducted to determine the reason and take necessary corrective action where appropriate.

This data can also be used for financial planning. If productivity ratios (average credit hours produced per FTE faculty member) are known, staffing levels can be projected by department then multiplied by average salary to project departmental faculty salary needs. Other components of departmental expenditures can be projected as a function either of credit hours, headcount students, FTE faculty or headcount faculty, or student credit hours.

The above applications are illustrative and not intended to be exhaustive of potential uses. Undoubtedly, each institution and users within each institution will find new and creative uses of the data and utility. Indeed, mere perusal of the reports and attempts to explain unexpected relationships are sufficient to justify the exercise.

CONCEPTUAL BASE AND SAMPLE CALCULATIONS

A. CONCEPTUAL BASE:

The underlying conceptual framework for this Student Flow System is the Markov Process. The Markov model was chosen because of its conceptual simplicity and because among all the curve fitting methods for projecting student enrollments (See Wing, 1974) it best replicates the real world student flow process. A Markov process is a stochastic process in which the transition probabilities depend upon the preceeding state or event. As applied to university student flow modeling this means simply that the probability of a student becoming a senior accounting major next autumn quarter is conditional on his/her student major/level state in the current autumn quarter. These probabilities are estimated from his/her state in the previous autumn quarter, etc. Transition probabilities in the Markov process are calculated from each individual student rather than by groups of students.

Implicitly, since the model relies on historical data it assumes that future transition rates will be similar to past transition rates at least through the time period being forecast. If the future were always like the past, however, there would be no need for planners and forecasters or for the system described in this document. Ample provision, therefore, has been made for modification of historically generated transition probabilities to reflect anticipated future changes in curricular requirements, student preferences, etc.

B. SAMPLE CALCULATION

This section describes the processing flow of individual student records required to produce projected departmental workloads. Historical transition probabilities are calculated from individual student records and are then multiplied by the most recent term's headcounts. The results are projected headcount majors which are multiplied through the columns of the historical or projected headcount Curriculum Matrix producing a projected Instructional Work Load Matrix (IWLM). The row totals of the IWLM are the projected departmental student credit hour workloads. The following sample calculation will make this process more clear.

The first step is to calculate historical transition probabilities from individual student records from two semesters or terms. The calculation follows a two-step process, as illustrated in Figure 4. The first step is to build a headcount matrix that simply counts the number of students in each transition category. For example, the number of students in major A in 1978 who were in major B in 1977; the number of students in major A in 1978 that were not enrolled in 1977; or the number of students in major A in 1977 who were not enrolled in 1978. The second step is to divide the headcounts by the column totals to estimate the transition percentages (or probabilities). Notice that this calculation gives transition rate estimates for exiting students and a prediction of the distribution of entering students as well as an estimate of the flow percentages between majors.

The next step of the calculations is to use these transition rates as a predictor of future enrollments. This process is illustrated in Figure 5. The most recent year's enrollment is used along with an estimate of the number of new students expected. These are multiplied by the transition percentages from Figure 4 to produce an estimate of the headcount enrollment by major. Thus, projected fall 1979 type A major headcount is 870 (900 x .4 + 1,000 x .1 + 1,000 x .1 + 1,100 x .1 + 1,000 x .2).

FIGURE 4
CALCULATION OF TRANSITION PERCENTAGES FROM HISTORICAL DATA

	HEADCOUNT MATRIX OF STUDENTS IN TWO TIME PERIODS:	FALL 1977					
		MAJOR A	MAJOR B	MAJOR C	MAJOR D	ENTERING STUDENTS NOT ENROLLED 1977)	STUDENTS
FALL 1978	MAJOR A	400	100	100	100	200	900
	MAJOR B	100	400	100	150	250	1,000
	MAJOR C	200	150	350	100	200	1,000
	MAJOR D	50	150	200	350	350	1,100
	EXITING STUDENTS (NOT ENROLLED IN 1978)	250	200	250	300		1,000
	TOTAL 1977 STUDENTS	1,000	1,000	1,000	1,000	1,000	

FIGURE 4 (CONTINUED)
CALCULATION OF TRANSITION PERCENTAGES FROM HISTORICAL DATA

TRANSITIONAL PROBABILITY MATRIX,
(HEADCOUNT MATRIX DIVIDED
BY COLUMN TOTALS):

	MAJOR A	MAJOR B	MAJOR C	MAJOR D	ENTERING STUDENTS
MAJOR A	.40	.10	.10	.10	.20
MAJOR B	.10	.40	.10	.15	.25
MAJOR C	.20	.15	.35	.10	.20
MAJOR D	.05	.15	.20	.35	.35
EXITING STUDENTS	.25	.20	.25	.30	

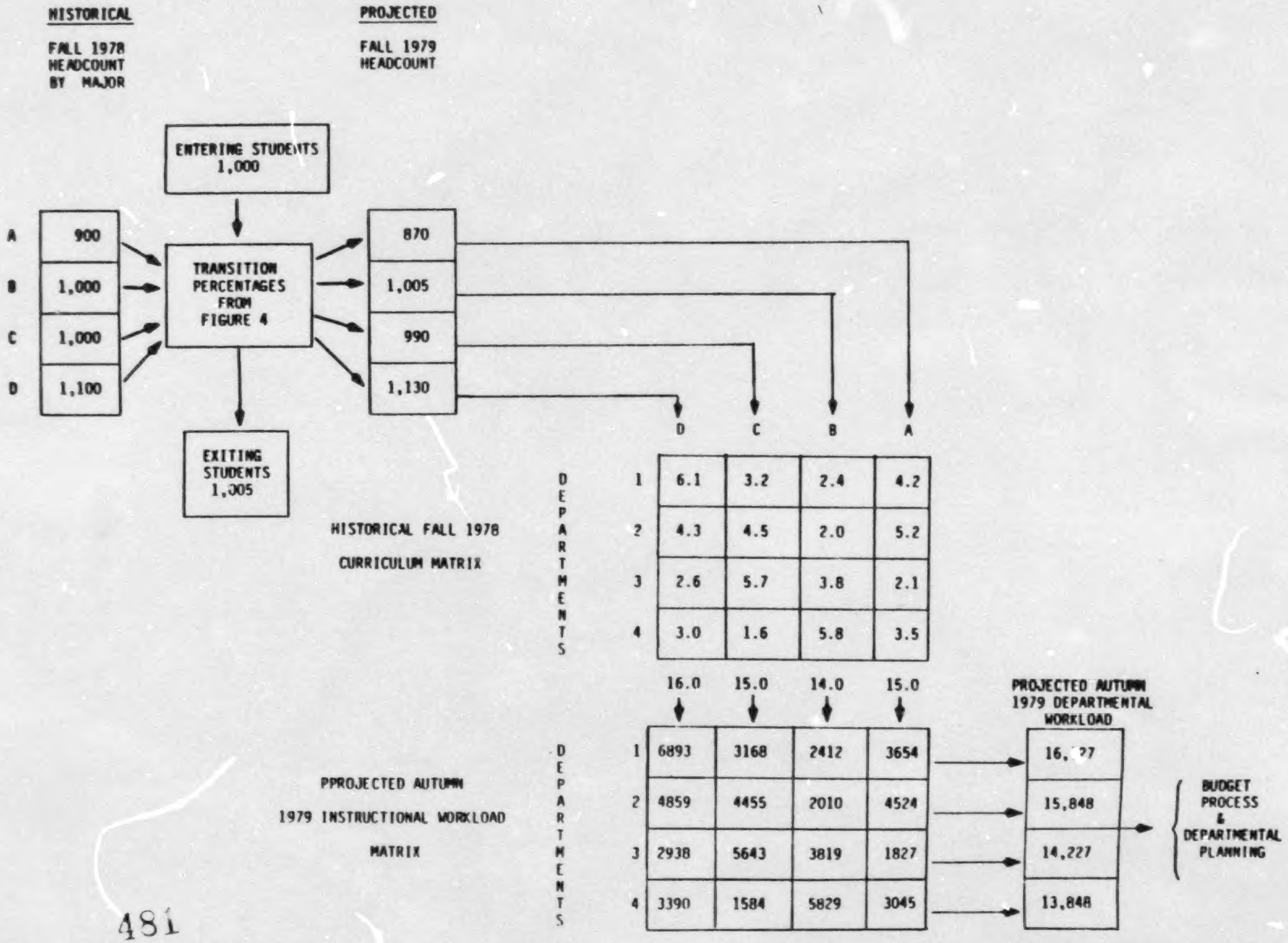
These projected headcount majors are then multiplied through the columns of the curriculum matrix, producing an Instruction Work Load Matrix (IWLM). The Autumn 1978 historical curriculum matrix (Figure 5) shows in Autumn 1978 that the average Type A headcount major took 4.2 credit hours from department 1. Since we project 870 Autumn 1979 Type A headcount majors, we project the resulting workload induced on Department 1 will be 3,654 (870 x 4.2). Similarly, the 1,005 projected Type B majors will take, on the average, 2.4 credit hours from department 1, resulting in 2,412 projected credit hours. Similar calculations for all cells of the curriculum matrix complete the instructional workload matrix shown in Figure 5.

Finally, by summing the rows of the IWLM, we obtain projected Autumn 1979 departmental workloads and credit hours. In the sample calculation, projected credit hours are:

1. 16,127
2. 15,848
3. 14,227
4. 13,848

FIGURE 5

SAMPLE CALCULATION OF DEPARTMENT WORKLOADS


HISTORICAL
FALL 1978 HEADCOUNT BY MAJOR
PROJECTED
FALL 1979 HEADCOUNT
ENTERING STUDENTS 1,000
A 900
B 1,000
C 1,000
D 1,100
TRANSITION PERCENTAGES FROM FIGURE 4
870
1,005
990
1,130
EXITING STUDENTS 1,005
D
C
B
A
HISTORICAL FALL 1978
CURRICULUM MATRIX
DEPARTMENTS
16.0
15.0
14.0
15.0
PPROJECTED AUTUMN
1979 INSTRUCTIONAL WORKLOAD
MATRIX
PROJECTED AUTUMN 1979 DEPARTMENTAL WORKLOAD
BUDGET PROCESS & DEPARTMENTAL PLANNING

HISTORICAL FALL 1978 CURRICULUM MATRIX

DEPARTMENTS	D	C	B	A
1	6.1	3.2	2.4	4.2
2	4.3	4.5	2.0	5.2
3	2.6	5.7	3.8	2.1
4	3.0	1.6	5.8	3.5
	16.0	15.0	14.0	15.0

PPROJECTED AUTUMN 1979 INSTRUCTIONAL WORKLOAD MATRIX

DEPARTMENTS					PROJECTED AUTUMN 1979 DEPARTMENTAL WORKLOAD
1	6893	3168	2412	3654	16,[illegible]27
2	4859	4455	2010	4524	15,848
3	2938	5643	3819	1827	14,227
4	3390	1584	5829	3045	13,848

SAMPLE REPORTS

This section contains sample output reports for:

A. The transition probability matrix of the Student Flow Model (Figure 6);

B. The projected headcount enrollments report of the Student Flow Model (Figure 7);

C. A Curriculum Matrix Credit Hours Taken Report (Figure 8);

D. A Curriculum Matrix Credit Hours Taught Report (Figure 9).

A. HISTORICAL TRANSITION REPORT - Figure 6

1 indicates the sending and receiving time periods. In this case the flow of students is from "sending" Autumn 1977 to "receiving" Autumn 1978. **2** is the sending major code (06). **3** is the sending major name (Math and Physical Sciences). **4** indicates the level code of student majors for the Autumn 1977 sending term (3-Jr.) **5** is the number of Math and Physical Science juniors, Autumn 1977 who became senior Math and Physical Science majors by Autumn 1978. **6** 67 is 53.17% of 126. This is the "flow" or transition probability. The value .5317 will be used later to project the flow of Autumn 1978 junior level Math and Physical Science majors to Autumn 1979 senior level Math and Physical Science majors. **7** is the cumulative transition probability through this row of the printout. **8** indicates the total number of junior level Math and Physical Science majors Autumn Quarter 1977.

B. PROJECTED HEADCOUNT ENROLLMENTS - Figure 7

9 indicates the major level state being projected. In this case major 06 equals Math and Physical Sciences. The student level being projected is rank 4 which is senior.**10** indicates the major level states from which students will transit in the sending term. **11** indicates that there were 129 junior Math and Physical Science students in Autumn 1978. **12** indicates that 53.17% of the 129 junior Math and Physical Science majors in Autumn Quarter of 1978 are projected to transit to senior Math and Physical Science majors in Autumn Quarter 1979 producing **13** 68.5893 of the 150.7974 projected Autumn 1979 Math and Physical Sciences senior headcount enrollments will come from prior year's junior Math and Physical Sciences headcount enrollments. **14** isthe total projected headcount enrollment for Autumn Quarter 1979 senior level Math and Physical Science majors (150).

CURRICULUM MATRIX

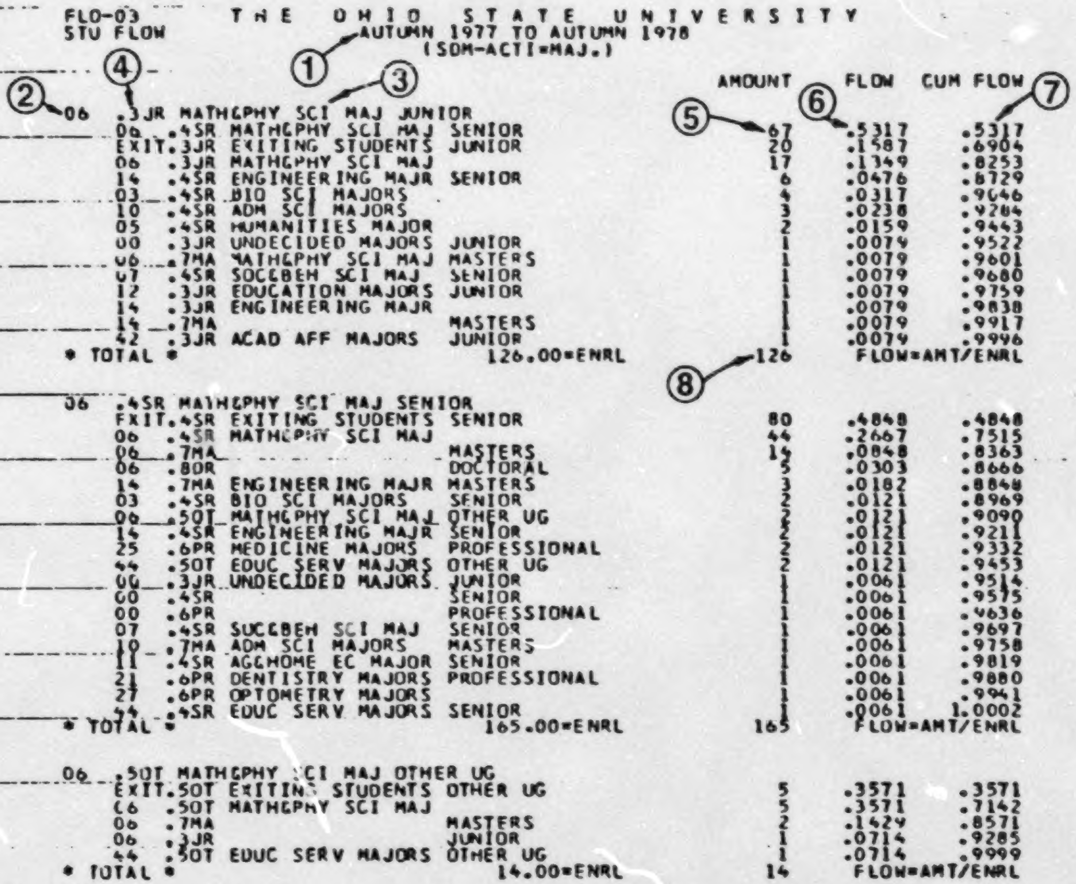
CREDIT HOURS TAKEN REPORT - Figure 8

15 indicates this printout is an ICLM or Curriculum Matrix Report. **16** is the student major code. **17** is the student major name. **18** is the code for the department offering the course. **19** is the name of the department offering the course. **20** is the number of credit hours taken by Economics students in each department. **21** is the percentage of all credit hours taken by Economics students in courses offered by each department. **22** is the cumulative percent of credit hours taken by Economics students. **23** is the total number of credit hours taken by Economics students. **24** indicates this is a Credit Hours Taken Report (i.e., student major to discipline).

CREDIT HOURS TAUGHT REPORT - Figure 9

25 indicates this printout is an ICLM or CM report. **26** indicates this is a Credit Hours Taught Report (i.e., discipline to student major). **27** is the code for the department offering the courses. **28** is the name of the department offering the course. **29** are the codes for the student majors taking the courses. **30** are the names of the majors taking the courses. **31** is the number of credit hours taken by each major in Entomology courses. **32** is the percentage of credit hours taken by the various majors in Entomology courses. **33** is the cumulative percentage. **34** is the total number of credit hours taught in the Entomology Department.

FIGURE 6

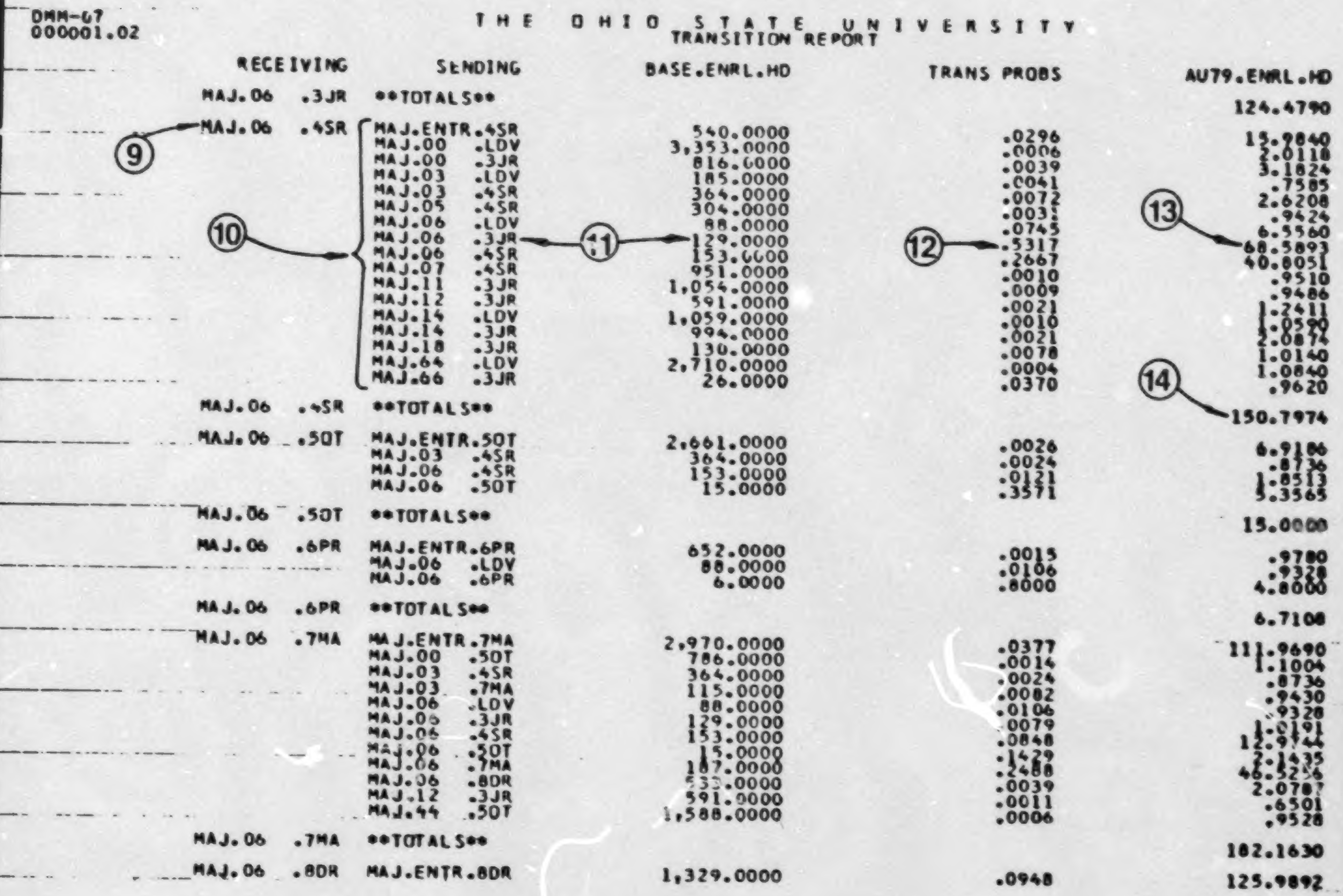


```
FLO-03         T H E   O H I O   S T A T E   U N I V E R S I T Y
STU FLOW                AUTUMN 1977 TO AUTUMN 1978
                               (SOM-ACTI=MAJ.)
                                                      AMOUNT    FLOW   CUM FLOW
06   .3JR MATHGPHY SCI MAJ JUNIOR
     06   .4SR MATHGPHY SCI MAJ  SENIOR                   67   .5317    .5317
     EXIT.3JR EXITING STUDENTS  JUNIOR                   20   .1587    .6904
     06   .3JR MATHGPHY SCI MAJ                          17   .1349    .8253
     14   .4SR ENGINEERING MAJR  SENIOR                   6   .0476    .8729
     03   .4SR BIO SCI MAJORS                             4   .0317    .9046
     10   .4SR ADM SCI MAJORS                             3   .0238    .9284
     05   .4SR HUMANITIES MAJOR                           2   .0159    .9443
     00   .3JR UNDECIDED MAJORS  JUNIOR                   1   .0079    .9522
     06   .7MA MATHGPHY SCI MAJ  MASTERS                  1   .0079    .9601
     07   .4SR SOCGBEH SCI MAJ   SENIOR                   1   .0079    .9680
     12   .3JR EDUCATION MAJORS  JUNIOR                   1   .0079    .9759
     14   .3JR ENGINEERING MAJR                           1   .0079    .9838
     14   .7MA                   MASTERS                  1   .0079    .9917
     42   .3JR ACAD AFF MAJORS   JUNIOR                   1   .0079    .9996
* TOTAL *                           126.00=ENRL         126    FLOW=AMT/ENRL

06   .4SR MATHGPHY SCI MAJ SENIOR
     EXIT.4SR EXITING STUDENTS  SENIOR                   80   .4848    .4848
     06   .4SR MATHGPHY SCI MAJ                          44   .2667    .7515
     06   .7MA                   MASTERS                 14   .0848    .8363
     06   .8DR                   DOCTORAL                 5   .0303    .8666
     14   .7MA ENGINEERING MAJR  MASTERS                  3   .0182    .8848
     03   .4SR BIO SCI MAJORS    SENIOR                   2   .0121    .8969
     06   .5OT MATHGPHY SCI MAJ  OTHER UG                 2   .0121    .9090
     14   .4SR ENGINEERING MAJR  SENIOR                   2   .0121    .9211
     25   .6PR MEDICINE MAJORS   PROFESSIONAL             2   .0121    .9332
     44   .5OT EDUC SERV MAJORS  OTHER UG                 2   .0121    .9453
     00   .3JR UNDECIDED MAJORS  JUNIOR                   1   .0061    .9514
     00   .4SR                   SENIOR                   1   .0061    .9575
     00   .6PR                   PROFESSIONAL             1   .0061    .9636
     07   .4SR SOCGBEH SCI MAJ   SENIOR                   1   .0061    .9697
     10   .7MA ADM SCI MAJORS    MASTERS                  1   .0061    .9758
     11   .4SR AGGHOME EC MAJOR  SENIOR                   1   .0061    .9819
     21   .6PR DENTISTRY MAJORS  PROFESSIONAL             1   .0061    .9880
     27   .6PR OPTOMETRY MAJORS                           1   .0061    .9941
     44   .4SR EDUC SERV MAJORS  SENIOR                   1   .0061   1.0002
* TOTAL *                           165.00=ENRL         165    FLOW=AMT/ENRL

06   .5OT MATHGPHY SCI MAJ OTHER UG
     EXIT.5OT EXITING STUDENTS  OTHER UG                  5   .3571    .3571
     06   .5OT MATHGPHY SCI MAJ                           5   .3571    .7142
     06   .7MA                   MASTERS                  2   .1429    .8571
     06   .3JR                   JUNIOR                   1   .0714    .9285
     44   .5OT EDUC SERV MAJORS  OTHER UG                 1   .0714    .9999
* TOTAL *                            14.00=ENRL          14    FLOW=AMT/ENRL
```

FIGURE 7



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DMM-07                     T H E   O H I O   S T A T E   U N I V E R S I T Y
000001.02                                 TRANSITION REPORT

           RECEIVING         SENDING          BASE.ENRL.HD          TRANS PROBS          AU79.ENRL.HD
      MAJ.06   .3JR   **TOTALS**                                                             124.4790
      MAJ.06   .4SR   MAJ.ENTR.4SR                540.0000               .0296                15.9840
                      MAJ.00   .LDV             3,353.0000               .0006                 2.0118
                      MAJ.00   .3JR               816.0000               .0039                 3.1824
                      MAJ.03   .LDV               185.0000               .0041                  .7585
                      MAJ.03   .4SR               364.0000               .0072                 2.6208
                      MAJ.05   .4SR               304.0000               .0031                  .9424
                      MAJ.06   .LDV                88.0000               .0745                 6.5560
                      MAJ.06   .3JR               129.0000               .5317                68.5893
                      MAJ.06   .4SR               153.0000               .2667                40.8051
                      MAJ.07   .4SR               951.0000               .0010                  .9510
                      MAJ.11   .3JR             1,054.0000               .0009                  .9486
                      MAJ.12   .3JR               591.0000               .0021                 1.2411
                      MAJ.14   .LDV             1,059.0000               .0010                 1.0590
                      MAJ.14   .3JR               994.0000               .0021                 2.0874
                      MAJ.18   .3JR               130.0000               .0078                 1.0140
                      MAJ.64   .LDV             2,710.0000               .0004                 1.0840
                      MAJ.66   .3JR                26.0000               .0370                  .9620
      MAJ.06   .4SR   **TOTALS**                                                             150.7974
      MAJ.06   .5OT   MAJ.ENTR.5OT              2,661.0000               .0026                 6.9186
                      MAJ.03   .4SR               364.0000               .0024                  .8736
                      MAJ.06   .4SR               153.0000               .0121                 1.8513
                      MAJ.06   .5OT                15.0000               .3571                 5.3565
      MAJ.06   .5OT   **TOTALS**                                                              15.0000
      MAJ.06   .6PR   MAJ.ENTR.6PR                652.0000               .0015                  .9780
                      MAJ.06   .LDV                88.0000               .0106                  .9328
                      MAJ.06   .6PR                 6.0000               .8000                 4.8000
      MAJ.06   .6PR   **TOTALS**                                                               6.7108
      MAJ.06   .7MA   MAJ.ENTR.7MA              2,970.0000               .0377               111.9690
                      MAJ.00   .5OT               786.0000               .0014                 1.1004
                      MAJ.03   .4SR               364.0000               .0024                  .8736
                      MAJ.03   .7MA               115.0000               .0082                  .9430
                      MAJ.06   .LDV                88.0000               .0106                  .9328
                      MAJ.06   .3JR               129.0000               .0079                 1.0191
                      MAJ.06   .4SR               153.0000               .0848                12.9744
                      MAJ.06   .5OT                15.0000               .1429                 2.1435
                      MAJ.06   .7MA               187.0000               .2488                46.5256
                      MAJ.06   .8DR               533.0000               .0039                 2.0787
                      MAJ.12   .3JR               591.0000               .0011                  .6501
                      MAJ.44   .5OT             1,588.0000               .0006                  .9528
      MAJ.06   .7MA   **TOTALS**                                                             182.1630
      MAJ.06   .8DR   MAJ.ENTR.8DR              1,329.0000               .0948               125.9892
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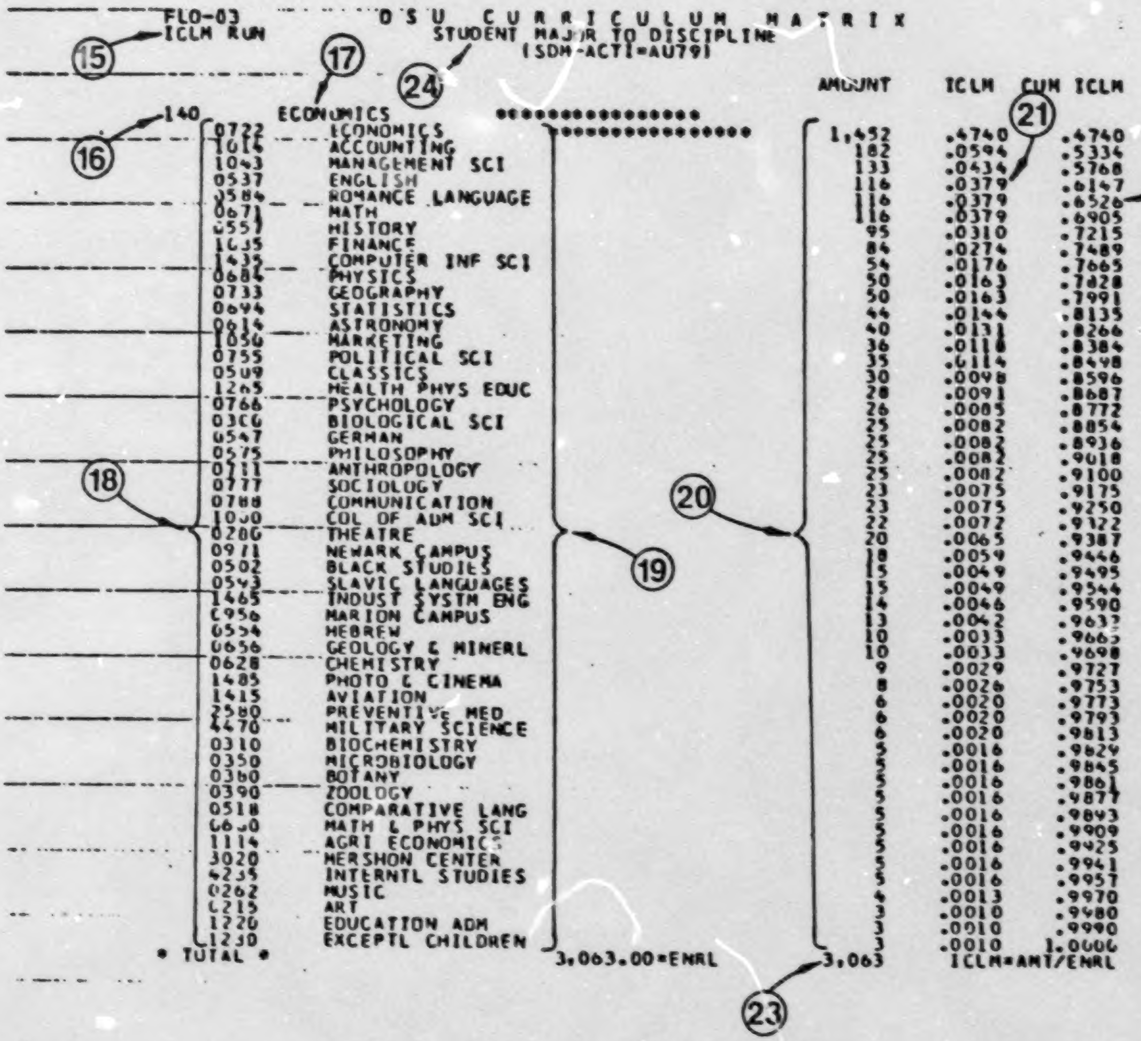
FIGURE 8


15
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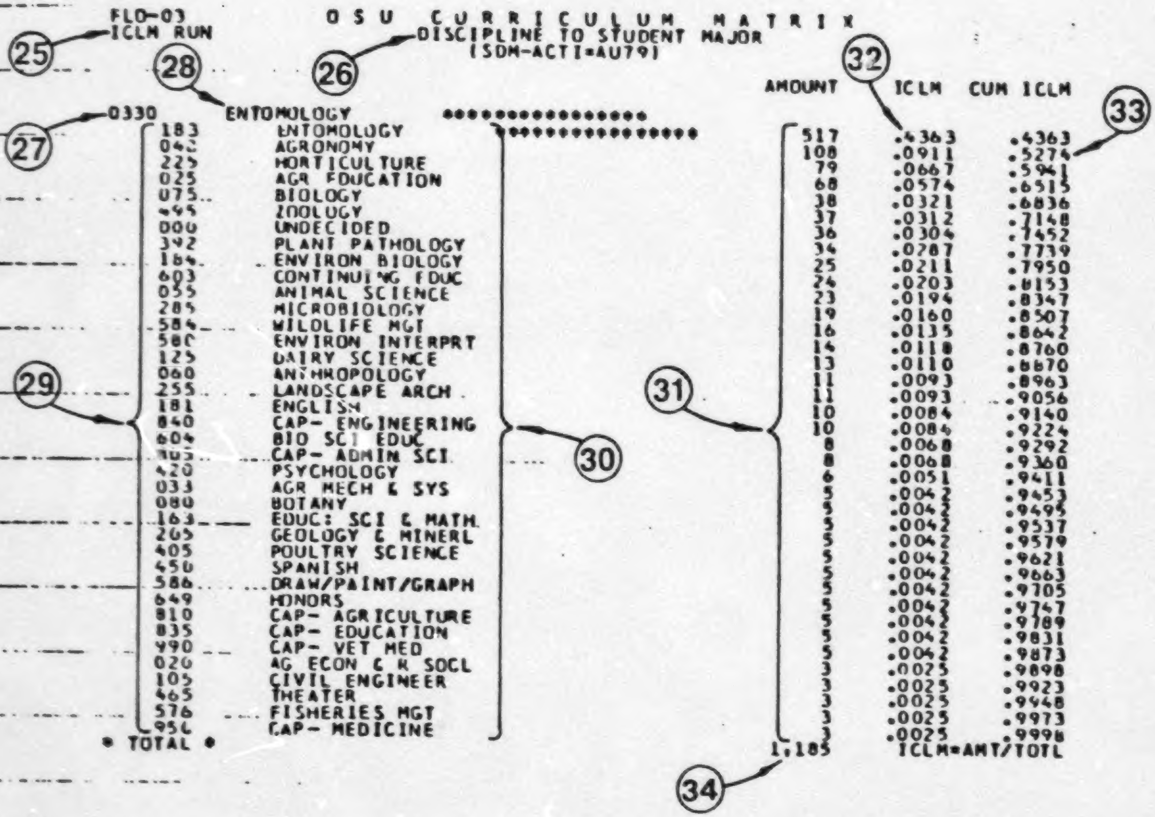
FLO-03          O S U   C U R R I C U L U M   M A T R I X
ICLM RUN                STUDENT MAJOR TO DISCIPLINE
                              (SDM-ACTI=AU79)
                                                               AMOUNT    ICLM   CUM ICLM
140         ECONOMICS              ****************
  0722      ECONOMICS                ****************          1,452    .4740    .4740
  1014      ACCOUNTING                                           182    .0594    .5334
  1043      MANAGEMENT SCI                                       133    .0434    .5768
  0537      ENGLISH                                              116    .0379    .6147
  0584      ROMANCE LANGUAGE                                     116    .0379    .6526
  0671      MATH                                                 116    .0379    .6905
  0557      HISTORY                                               95    .0310    .7215
  1035      FINANCE                                               84    .0274    .7489
  1435      COMPUTER INF SCI                                      54    .0176    .7665
  0684      PHYSICS                                               50    .0163    .7828
  0733      GEOGRAPHY                                             50    .0163    .7991
  0694      STATISTICS                                            44    .0144    .8135
  0614      ASTRONOMY                                             40    .0131    .8266
  1050      MARKETING                                             36    .0118    .8384
  0755      POLITICAL SCI                                         35    .0114    .8498
  0509      CLASSICS                                              30    .0098    .8596
  1265      HEALTH PHYS EDUC                                      28    .0091    .8687
  0766      PSYCHOLOGY                                            26    .0085    .8772
  0300      BIOLOGICAL SCI                                        25    .0082    .8854
  0547      GERMAN                                                25    .0082    .8936
  0575      PHILOSOPHY                                            25    .0082    .9018
  0711      ANTHROPOLOGY                                          25    .0082    .9100
  0777      SOCIOLOGY                                             23    .0075    .9175
  0788      COMMUNICATION                                         23    .0075    .9250
  1000      COL OF ADM SCI                                        22    .0072    .9322
  0200      THEATRE                                               20    .0065    .9387
  0971      NEWARK CAMPUS                                         18    .0059    .9446
  0502      BLACK STUDIES                                         15    .0049    .9495
  0543      SLAVIC LANGUAGES                                      15    .0049    .9544
  1465      INDUST SYSTM ENG                                      14    .0046    .9590
  0956      MARION CAMPUS                                         13    .0042    .9632
  0554      HEBREW                                                10    .0033    .9665
  0656      GEOLOGY & MINERL                                      10    .0033    .9698
  0628      CHEMISTRY                                              9    .0029    .9727
  1485      PHOTO & CINEMA                                         8    .0026    .9753
  1415      AVIATION                                               6    .0020    .9773
  2580      PREVENTIVE MED                                         6    .0020    .9793
  4470      MILITARY SCIENCE                                       6    .0020    .9813
  0310      BIOCHEMISTRY                                           5    .0016    .9829
  0350      MICROBIOLOGY                                           5    .0016    .9845
  0360      BOTANY                                                 5    .0016    .9861
  0390      ZOOLOGY                                                5    .0016    .9877
  0518      COMPARATIVE LANG                                       5    .0016    .9893
  0600      MATH & PHYS SCI                                        5    .0016    .9909
  1114      AGRI ECONOMICS                                         5    .0016    .9925
  3020      MERSHON CENTER                                         5    .0016    .9941
  4235      INTERNTL STUDIES                                       5    .0016    .9957
  0262      MUSIC                                                  4    .0013    .9970
  0215      ART                                                    3    .0010    .9980
  1220      EDUCATION ADM                                          3    .0010    .9990
  1230      EXCEPTL CHILDREN                                       3    .0010   1.0000
 * TOTAL *                         3,063.00=ENRL               3,063    ICLM=AMT/ENRL
```

FIGURE 9



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FLO-03                 O S U   C U R R I C U L U M   M A T R I X
ICLM RUN                      DISCIPLINE TO STUDENT MAJOR
                                   (SDM-ACTI=AU79)
                                                              AMOUNT     ICLM   CUM ICLM
0330          ENTOMOLOGY          ***************
   183           ENTOMOLOGY                ***************     517      .4363    .4363
   042           AGRONOMY                                      108      .0911    .5274
   225           HORTICULTURE                                   79      .0667    .5941
   025           AGR EDUCATION                                  68      .0574    .6515
   075           BIOLOGY                                        38      .0321    .6836
   495           ZOOLOGY                                        37      .0312    .7148
   000           UNDECIDED                                      36      .0304    .7452
   392           PLANT PATHOLOGY                                34      .0287    .7739
   164           ENVIRON BIOLOGY                                25      .0211    .7950
   603           CONTINUING EDUC                                24      .0203    .8153
   055           ANIMAL SCIENCE                                 23      .0194    .8347
   285           MICROBIOLOGY                                   19      .0160    .8507
   584           WILDLIFE MGT                                   16      .0135    .8642
   580           ENVIRON INTERPRT                               14      .0118    .8760
   125           DAIRY SCIENCE                                  13      .0110    .8870
   060           ANTHROPOLOGY                                   11      .0093    .8963
   255           LANDSCAPE ARCH                                 11      .0093    .9056
   181           ENGLISH                                        10      .0084    .9140
   840           CAP- ENGINEERING                               10      .0084    .9224
   604           BIO SCI EDUC                                    8      .0068    .9292
   805           CAP- ADMIN SCI                                  8      .0068    .9360
   420           PSYCHOLOGY                                      6      .0051    .9411
   033           AGR MECH & SYS                                  5      .0042    .9453
   080           BOTANY                                          5      .0042    .9495
   163           EDUC: SCI & MATH                                5      .0042    .9537
   265           GEOLOGY & MINERL                                5      .0042    .9579
   405           POULTRY SCIENCE                                 5      .0042    .9621
   450           SPANISH                                         5      .0042    .9663
   586           DRAW/PAINT/GRAPH                                5      .0042    .9705
   649           HONORS                                          5      .0042    .9747
   810           CAP- AGRICULTURE                                5      .0042    .9789
   835           CAP- EDUCATION                                  5      .0042    .9831
   990           CAP- VET MED                                    5      .0042    .9873
   020           AG ECON & R SOCL                                3      .0025    .9898
   105           CIVIL ENGINEER                                  3      .0025    .9923
   465           THEATER                                         3      .0025    .9948
   576           FISHERIES MGT                                   3      .0025    .9973
   956           CAP- MEDICINE                                   3      .0025    .9998
 * TOTAL *                                                   1,185      ICLM=AMT/TOTL
```

VENDOR PRESENTATIONS

Coordinator:
Les Singletary
Southeastern Louisiana University

Ilene V. Kanoff
Peat, Marwick, Mitchell & Co.

Jerry Young
Systems & Computer Technology Corp.

Bob Wyman
Digital Equipment Corporation

Geoffrey Scott
Precision Visuals, Inc.

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Participation of the following companies in the 1982 CAUSE National Conference was greatly appreciated:

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AMS was founded in 1970 and is one of the largest independent computer systems and services firms in the United States, with over 900 employees and projected 1982 revenues in excess of $70 million. AMS is headquartered in Arlington, Virginia and has regional offices in New York, Chicago, San Francisco, Denver, Houston, and Orlando.

AMS has been a leader in the development of major, complex financial accounting systems for government and industry. One of AMS's most notable successes was the development of the Integrated Financial Management System (IFMS) for New York City in the wake of the city's fiscal crisis in the mid-70s. Many of the techniques developed in building this large scale fund accounting system have been utilized in the development of CUFS.

CUFS - the College and University Financal System - is the first completely online, interactive, packaged financial management system designed specifically for colleges and universities. It provides fund accounting in accordance with NACUPO and AICPA guidelines, including encumbrance control, flexible budgeting facilities, revenue and expenditure accounting, and extensive grants management facilities. CUFS handles all of the normal fund groups including current funds (unrestricted and restricted), endowment funds, plant funds, loan funds, etc.

CUFS is fully integrated. This means that, in addition to general ledger features, the system includes, in one data base, budgeting, accounting, purchasing, payables and receivables, indirect cost recovery, and management and financial reporting - all in a single system.

In addition to the capabilities mentioned above, AMS offers optional sub-systems to complement CUFS in the areas of job cost accounting, fixed asset management, investment management, and performance measurement. These additional sub-systems may be added to the base system at any time.

Since CUFS is a packaged software product, a one year warranty is provided and an annual maintenance agreement is available. Thus clients receive annual upgrades to the system based upon development priorities set in consultation with the CUFS users group. In addition, a telephone consultation service is provided to help clients best utilize their CUFS system.

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Reporting under CUFS is extensive. Over 150 standard reports are provided including transaction listings, account code listings, budget preparation reports, budget vs. actual reports, accounting management reports, financial statements, open item listings, and the three NACUBO mandated financial statements -- the balance sheet, the statement of changes in fund balances, and the statement of current funds revenues, expenditures and other changes, among others.

Among the special features of CUFS which existing clients have found particularly attractive are the following.

- CUFS is tailored to the user's environment through the selection of options and controls in user-maintained master tables.
- A budget modeling facility allows users to test the consequences of various budget increase or decrease options.
- CUFS offers a variety of budget control features applicable to different institutions, or different funds or administrative areas within the same institution.
- Extensive and flexible support is provided for grants and contracts, including automated indirect cost recovery and letter of credit drawdowns.
- A full array of on-line facilities is available, including
    - Data Entry, for immediate processing or held for later off-line processing.
    - Error Correction of previously entered documents.
    - Inquiry of account balances, open items, budget amounts, etc.
    - Table Maintenance for control options, account codes, and other reference information.
- AMS provides extensive installation support to assist clients with learning to use CUFS, setting up their chart of accounts, selecting control options, training, data conversion, and initial operations support.
- CUFS is furnished with four volumes of documentation to support management, accounting staff, users, data entry personnel and data processing staff.

Descriptive material about CUFS may be requested by contacting AMS at the above address.

CONTROL DATA

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Mailing Address/Box 130028
Sacramento, California 95813

SAM (Student Aid Management) Demonstrated at 1982 CAUSE Convention

Developed by Sigma Systems, Inc., a subsidiary of Systems Research, Inc., SAM is available in either on-line mode or batch processing. All programs are written in ANSI COBOL and come with a comprehensive set of technical and user documentation. SAM is available on Control Data CYBER 170 Series 700 or 880 computers.

Student Aid Management (SAM) is a comprehensive package of computer programs that supports the administration of student financial aid in colleges, universities and state agencies.

SAM automates application tracking, student need analysis, evaluation, packaging, notification, disbursement, funds management, reporting and analysis and compliance monitoring. It also performs routine clerical functions, thus freeing financial aid administrators to work on individual situations requiring professional judgement.

The program requires no special application form and can use the financial aid application desired by an institution for initial data input. It also accepts data for need analysis from the American College Testing Service (ACT), the College Scholarship Service (CSS), the Graduate and Professional School Financial Aid Service (GAPSFAS), and PELL.

SAM also has a U.S. Office of Education-approved need analysis capability that can be used in lieu of or in conjunction with any of the nation processors for establishing eligibility for the campus-based programs of Federal student assistance.

* * BENEFITS * *

SAM can generate transactions to the business office so that it can record awards on student billings or accounts. The same data can be transmitted to the institutional accounting and loan billing systems to minimize duplicate entry.

SAM also:

* Reduces handling of forms and student folders.
* Generates follow-up letters on a regular basis.
* Eliminates manually addressed envelopes.
* Performs need-analysis recomputations immediately.
* Avoids lengthy time for award packaging.

The system helps administrators gain control of the entire process by knowing the status of each application, the balance of each program, the activity on each campus, the outcome of each payment authorization, and the results of each revision.

The SAM modules can be used independently or in various combinations. In addition, SAM can be used independently of any other institutional systems. It can also be interfaced with other systems to use existing student data and eliminate the necessity of duplicate data entry.

digital

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Roger Uphoff
Office Product Development
Merrimack, N.H.

Carolyn Barron
Administrative Products Mngr
Marlboro, Mass

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The ALL-IN-1 system integrates an impressive array of office functions in one all-inclusive package:

- Word processing
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- Calculator
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- Resource scheduling
- Electronic file cabinet
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- Spelling Checker

And you can tailor your ALL-IN-1 system to your precise needs. If you've got unique tasks to do, DIGITAL can help you incorporate them in your ALL-IN-1 system regardless of whether you developed them, bought them from a third party, or bought them from DIGITAL.

The ALL-IN-1 system runs on DIGITAL's high-performance VAX computers. Because of its human-engineered design, the ALL-IN-1 system is a simple user interface to the power of the VAX systems. And, it's available in several offerings depending on your needs and experience. In addition, the ALL-IN-1 system/VAX combination provides unmatched opportunities for growth and customization.

********* * A CLOSER LOOK AT ALL-IN-1 **********

The ALL-IN-1 Package includes a full range of features to facilitate information handling in your office.

USER-ORIENTED WORD PROCESSING

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PACESETTING ELECTRONIC MAIL

Based on the experience of its networking and communications systems, DIGITAL designed and built an electronic mail system that has established industry standards. You can send vital operating information instantly to others who need it. And they, in turn, can respond to that information or to your queries instantly. The electronic mail feature includes extensive storage, search, and retrieval capabilities to manage the mail you create, file, send, and receive.

DESK MANAGEMENT SIMPLIFIED

The ALL-IN-1 system's Desk Management feature helps you to organize and expedite repetitive, work-a-day tasks. These tasks include updating tickler files, accessing and maintaining phone directories, scheduling meeting and conference rooms, managing your calendars, and distributing meeting agendas.

The Desk Management feature looks up phone numbers faster than you can find and open your phone directory. It flags action items on your tickler file, reminding you to deal with those items you've marked as high priority. It schedules meetings for you based on the attendees, meeting times, and meeting rooms you specify. When it finds a time and place agreeable to all, it books the room, marks everyone's calendars, and informs the attendees. All automatically. If you decide to cancel the meeting, the Desk Management feature automatically notifies all the other attendees of the the cancellation.

Another convenient feature of the Desk Management function is the calculator. This capability lets you perform a wide variety of mathematical operations independently, just as you would with a separate desk calculator. You can then incorporate the results in documents, reports, graphs, or mail messages.

*** POWER AND PERFORMANCE UNMATCHED IN THE INDUSTRY ****

With all its functionality and flexibility, DIGITAL's ALL-IN-1 system is setting the standard for office information systems. This powerful package gives all users more control of the information they need to do their jobs well.

EDS
EDS Federal Corporation
7171 Forest Lane
Dallas, Texas 75230
(214) 661-6000

MODELING ADMINISTRATIVE INFORMATION SYSTEMS USING STRUCTURED ANALYSIS

As systems analysts begin to develop a new system, they frequently encounter four general problems: lack of experience; language problems with users; lack of precision in standard text specifications; and comprehension of the size and complexity of the system. EDS' solution to these problems centers around a design methodology called structured analysis. EDS' systems analysts are currently applying this methodology to the development of an administrative information system (AIS) for The Pennsylvania State University.

The goals of structured analysis are to solve the size and complexity problems; to provide precise communications; to use graphics where possible; and to ensure understanding of the users' needs.

For any design project, structured analysis begins in the first phase of the project life cycle, the current physical analysis phase. The analyst examines the current physical operation to understand the users' environment, policies and procedures.

The analyst begins by partitioning or dividing the system into successive levels of processes and data flows. This requires that the analyst examine and redesign computer programs and also examine the man/machine universe to understand the manual processes and flow of information. The design effort ensures that both manual and automated parts of the new system function effectively together.

The philosophy also directs that the system be user designed and that the business needs, not technology or the physical constraints of the environment, determine the flow of information. Frequent walkthroughs reviewing the documentation produced to date insure that the analyst understands the user's needs and that the user understands how the new system will function.

The three design tools of structured analysis are data flow diagrams, a data dictionary, and mini-specifications. Data flow diagrams are a graphic representation of the flow of information through the system. They identify the flow of data, define the processes, identify files or data stores and identify sources or destinations of the data. The data dictionary defines data flows and data stores as well as data elements. The dictionary makes no reference to size, edit criteria or other details at this point, but only carries the meaning of data elements. The mini-specifications describe processes on the data flow diagrams and, to ensure precise and accurate communication between the user and the analyst, are written using either structured English, decision trees or decision tables.

EDS' analysts designing a university AIS begin by interviewing the users about the flow of information received from organizations outside their office and about the processes performed with that information. Using the description of the processes, the analyst begins partitioning, or breaking down, the functions performed in each process and creates separate processes and new lower level data flow diagrams. Frequent interviews and walkthroughs with the user facilitate the continued partitioning process until it reaches the lowest level. At each level, the data dictionary is updated and information is stored concerning the contents and organization of the data files and data flows. This iterative process is continued until the user is satisfied that the data flow diagrams, data dictionary, and mini-specifications accurately reflect the current system.

The result of structured analysis is a system description that solves many of the traditional problems with system documentation. The AIS is reduced to understandable units through the partitioning process. The use of the precise communication tools provides for mutual understanding of both the users' needs and the system. Because of the continual walk-throughs and reviews throughout development, the user is not presented at the end of the analysis phase with a massive amount of documentation to review and approve. Since approval has been continuous, final approval is only a formality.

During the second phase of the project, the new logical design phase, the analyst reworks the documentation developed during the current physical analysis phase to provide a new logical design for the AIS and to include the user's expressed desire for changes and new features. Using the same goals, philosophy and tools, the analyst restructures the diagrams to provide a new system that minimizes the flow of data and the interfaces between processes.

New specifications are written for each process using the data flows that have been developed. From the data flows and the mini-specifications, the analyst also develops the logical user views of the data to provide a data base design. The result is a logical restructuring that provides data flow diagrams, data dictionary, mini-specifications, and a logical data base design which represent the new system.

The benefits of this structured analysis process are substantial. The system design includes the automated and manual administrative processes of the university and is not limited just to the computer programs. The system model is logical and is not constrained by physical or technical considerations, thus the system design is determined by the business needs of the university as specified by the users of the system. The use of structured analysis tools and frequent walkthroughs facilitate accurate communication between users and analysts. Most importantly, structured analysis ensures that the logical design accurately reflects the users needs and provides a foundation for the success of the new AIS.

International Business Machines Corporation

10401 Fernwood Road
Bethesda, Maryland 20817
301/897-2000

IBM has a variety of options available for implementing student information systems. Ultimately, the final decision of which system to use is decided after evaluating your institution's requirements against many factors, such as the functions provided, the cost associated with implementation and the benefits to be derived.

At CAUSE '82, we are pleased to present the following offerings. For the 4300, 303x and 308x environments, we have EIS/DB (Educational Information System/Database)and EIS/REGISTRATION. EIS/DB links together over 2000 data elements in eight databases to form a base for a comprehensive education support system. EIS/REGISTRATION uses those databases to provide a registration system. Some of the features of EIS/REGISTRATION includes support of arena style or online registration, add/drop processing, and an audit trail of transactions. Various size IBM 3270 Display Terminals are automatically supported as well as the IBM 3279 Color Display.

The IBM 8100 Student Registration system developed by the State University System of Florida utilizes the 8140 processor under DPCX. The system can be used for a standalone system or in a distributed mode. The system through a registration definition option can allow such functions as course conflict editing, variable grading options, variable credit options, holds, and other options to tailor the registration process to your institution's requirements.

Additional information may be obtained through your local IBM marketing representative or Ferne W. Ridley, Higher Education Industry, IBM Corporation, NAD, Dept. 60J, 10401 Fernwood Road, Bethesda, Maryland 20817

SYSTEMATIC EVALUATION AND SELECTION OF SOFTWARE

Industry experts have been developing some hard facts on software lately. They predict, for example, that the independent packaged software market will grow by 29 percent per year through the mid-1980's. Furthermore, the total market size will increase from worldwide revenues of $920 million in 1979 to an estimated $3.5 billion in 1984. During the same period, our industry watchers tell us, a significant number of existing firms will merge into large "full product line" software businesses, while an even larger number of new firms will enter the industry for the first time.

The explosive growth of packaged software brings an attendant dilemma for users. Simply stated, the question is this, which software should a manufacturer or service firm choose? As the buyer will soon discover, the fundamental question of how to determine the proper criteria for software evaluation and selection has become difficult to answer. Given the rapid rate of change in the industry, it will become harder than ever to purchase the optimum product at a fair price. What's more, the margin for error is shrinking; with costs inevitably increasing, the cost of selecting the wrong product will become all the more prohibitive.

Contrary to impressions created by vendor advertising, there is no clear-cut solution to these problems. As a result, many business unit managers, MIS managers, and others who must make frequent software decisions are turning to outside consultants for guidance.

A fundamental decision that consultants can help clients make is the question of whether to develop or buy software. Many large organizations traditionally relied on their internal development abilities because they doubted that an "outhouse" system could meet their specific needs adequately and inexpensively. Now, however, more organizations are discovering that packaged software can provide a permanent and complete solution to the problems that tend to plague in-house developed systems. Among these problems are:

- Customized software development costs are escalating rapidly.
- Implementing customized software requires long development lead time.
- Customized systems can be difficult and costly to maintain and change.

The skill and resources of consultants combined with a systematic vendor evaluation procedure typically will result in an appropriate software selection. The methodology for evaluating vendors includes the following steps:

1. The consultant determines the client's system requirements and prepares a detailed RFP. The RFP should include business requirements, software requirements, technical parameters, organizational structure, current systems and procedures, client goals and objectives, and evaluation methodology. Although each RFP specifically addresses each client's needs, our prior experience and writing tools can materially improve the quality and efficiency of RFP preparation.
2. After the RFPs are distributed to potential vendors, consultants work with the client to construct an analysis matrix. This matrix establishes weight factors for functional, technical, and product cost information that will be included in vendor proposals. Initial

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screening of proposals will identify the adequacy of the vendor's responses, after which vendors can be notified of any deficiencies and estimates can be obtained for the cost of correcting these deficiencies. It should be noted that many vendors have limited ability and even less desire to modify their software. Peat Marwick has found that in such cases a consultant may be able to assist in identifying other business organizations that can provide modification support.

The evaluation matrix can also be used to score vendors according to how well they have identified the organization's needs and how successful their track records (as indicated by reference lists) are.

Although this two-step approach is logical and can help the client select the appropriate vendor, it is important to note that it is only one source of input and should be evaluated in the full light of specific function and industry experience. Peat Marwick's specialists can efficiently prepare evaluation criteria and map vendor products to these criteria; however, we believe that it is after this point in the process that the client can most profit from our experience and ability to address specific questions about impact on user departments, appropriate organizational changes, and reasonable estimates of maintenance support.

In summary, Peat Marwick believes that a systematic software selection process, especially one conducted by an outside consultant, provides a number of advantages to an organization. Among the major benefits are:

- Time saving through availability of relevant information and skilled personnel. A typical Peat Marwick evaluation takes about 12 weeks, including three to four weeks for vendors to respond to the RFP.
- Cost savings through competitive bidding. Choosing from a number of vendors generally results in a lower price for software or in additional services provided by a vendor at no extra cost.
- Selection of a system that meets present and future requirements. If available packaged software can not meet specific needs, the consultant can advise the client and suggest alternatives for software development.
- Proposals from reliable vendors. Knowledge of the software market enables consultants to solicit bids from only those vendors with appropriate products and good reputations.
- Contract analysis to give the client a better negotiating position. Peat Marwick consultants can review to find weaknesses, deficiencies, and possible areas of client exposure.
- Impact analysis of major trends or product changes. Careful industry observation can reveal whether a vendor is planning to deemphasize a feature or level of support that would be critical to a client.

A systematic software evaluation program can cut through the maze of decisions that must be made in today's complex, changing marketplace. It can't totally replace old-fashioned business sense when the time comes to sign a contract for new software, but it will enable a manager to make a decision with confidence that all critical variables have been prudently examined.

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PrecisionVisuals™

Introduction to Device-Independent Computer Graphics

This session, presented by Precision Visuals, Inc., provided an overview of technologies and trends in computer graphics hardware and software. Incorporated in 1979, Precision Visuals, Inc., Boulder, Colorado, was formed with the charter to develop and market state-of-the-art graphics software tools. The corporate focus is toward professional software products, backed by quality documentation and customer support.

A series of introductory slides presented an assortment of computer graphics applications in a wide range of industries. These applications indicate the potential marketplace for computer graphics. The graphics industry is getting ready to boom. Until recent years the marketplace has been dominated by CAD/CAM packages. Present surveys forecast that trends are changing. The business graphics market will be the most explosive segment of the industry -- growing to nearly four times the current size in the next five years to approximately a $1 billion marketplace.

There are two basic categories of graphics hardware devices: passive and interactive. Passive graphics means graphics output to a graphics device which does not support operator interaction. Interactive graphics allows the operator to interact with the graphics program as it is running. Among the various graphics hardware devices, the emerging technology is the raster frame buffer device. To generate graphics on any class of graphics devices, passive or interactive, with a single application program is a concept known as device independence.

At some point in a device-independent graphics package, device-dependent output is generated. The module designated to handle device-dependent output is called the device driver or manager. Intelligent graphics device managers, wherever possible, perform graphics functions using the firmware of the display device. While the device drivers are more complex, the throughput through the system is much more efficient, less memory is required, and the general system is more easily configured in a network environment. Precision Visuals' DI-3000 is used as a model of a device-independent graphics system.

DI-3000 is a rich set of graphics development tools, based on the CORE-system graphics standard, that underlies all Precision Visuals' software products. Contouring is a subroutine package that provides the capabilities one needs to build detailed contour maps. The Metafile System is a package which allows a user to generate, store, compose, and recall a picture library that is device- and machine-independent. GRAFMAKER is a high-level graphics software toolbox for generating line graphs, bar graphs, pie charts, and text charts.

User-friendliness is explored as a misnomer in the computer industry. Several alternatives exist for a non-programmer interface. They are prompt-, command-, and panel-driven. After over eighteen months of intensive design consideration, Precision Visuals has adopted a modified panel-driven system as a basis for GRAFMASTER. GRAFMASTER provides standardized interface panels for interactively generating both simple and sophisticated presentation charts; line and bar graphs, pie and text charts, and combinations thereof.

Systems & Computer Technology Corporation

Series II Family of Systems

Within the highly technical, swiftly changing computer industry, a company's long-term growth and ultimate success potential is largely dependent on an ability to accurately predict future trends in its field of expertise. That's why SCT established a Software Systems Task Force in 1978 to evaluate and update existing systems, as well as to recommend and develop product lines to meet the projected needs for the 80's.

Four years later their efforts are paying enormous dividends, with SCT firmly entrenched as the pioneer and leader in providing systems to higher education. The firm's Series II Family of Systems include the Integrated Financial Information Systems (IFIS/II), Human Resources Information System (HRIS/II), and Integrated Student Information System (ISIS/II)—for financial management and accounting, human resources, and student information processing. The Series II Family of Systems—the results of millions of dollars and thousands of person-years in labor—are the only fully on-line, totally integrated, data base managed applications software products for higher education on the market today! Estimates place this state-of-the-art technology at least five years ahead of the competition.

Response from the higher education community has been overwhelmingly positive. Colleges and universities nationwide are selecting SCT's Series II Family of Systems—especially after careful, extensive evaluations of available alternatives. They have discovered that the Family of Systems is the only administrative software product line for higher education which provides management and office staff the information they need, when they need it, in a form they can use, without technical translation.

The efficient answer to information needs of the 80's . . . through functional design and advanced technology.

SCT's state-of-the-art computerized systems eliminate many inefficient retrieval and clerical tasks, providing administrators with timely, accurate information required for effective management of such current higher education challenges as:

- Demands for immediate access to information;
- Multi-campus, off-campus, and other geographical/organizational requirements;
- Rising costs and subsequent budgetary and staffing restrictions;
- Increased reporting burden from federal and state agencies;
- Equal Employment Opportunity regulations;
- Unionization.

Emphasizing the value of information and the financial, human, and technological resources necessary to support information processing, SCT's data base management approach integrates user procedures and related computer systems into an efficient administrative operation. The Series II Family of Systems provides organized data in a logical, highly-structured order through various modules.

Accountability and Collective Expertise

The use of SCT technical staff, on site, enables the client to focus accountability and responsibility on a single source in solving the major objectives of planning, design, and installation of new administrative systems, or upgrading older systems. Under this approach, the client is able to hold SCT accountable for software development, implementation, and maintenance activities—on schedule, within agreed-upon budget—resulting in improved service levels to users.

SCT offers a cadre of computing experts who have several advantages over individually selected staff, no matter how skilled. SCT professionals bring to bear on the client's site a collective, corporate experience which permits rapid, effective implementation of new procedures and techniques to solve most computing problems. Furthermore, the SCT technical team has easy access to peers at other SCT sites throughout the country—a rich and ready source for problem definition and advanced technology.

HRIS/II

Acknowledging the challenge of creating responsive, cost-effective administrative information systems, SCT has developed a data base managed Human Resources Information System (HRIS/II) which thoroughly addresses the management and administration of personnel and the personnel services budget for a college or university. HRIS/II is comprised of three interrelating components, consisting of payroll, personnel, and position budgeting/control, which can expedite all information processing activities while reducing errors in repetitive clerical tasks associated with these key functions. The system provides users with "valuable data"—data which is timely, comprehensive, and easily accessible, with broad update capabilities. All components are integrated and on line, supporting immediate data entry and information retrieval.

IFIS/II

The Integrated Financial Information Systems (IFIS/II) offers clients a cost-effective means to improve financial data accountability/control, produce timely, accurate reports, and reduce manual operations and associated costs. IFIS/II is divided into five distinct subsystems: Fund Accounting System, Budget Preparation, Accounts Payable, Accounts Receivable, and Fixed Assets. Together they form an overall integrated management system which can answer most financial reporting needs for any client—whether two- or four-year, public or private, single facility or multi-campus environments.

ISIS/II

To provide needed student-related data, SCT designed its on-line Integrated Student Information System (ISIS/II). ISIS/II collects, processes, stores, retrieves, and can provide demographic, biographic, academic history, and student financial data. It maintains all student information on pre-applicants through continuing and recently enrolled students. Using a common data base, it streamlines records modification, reduces clerical work, and insures timely, efficient information processing for users.

System modules are completely compatible in order to provide the proper integration between student system components and related accounting system components. Together, they work to establish a base of data. The system is designed for maximum data security to prevent illegal or unauthorized access.

The unique SCT information system further provides an audit trail for verification of changes, as well as backup files for recreation or recovery in case of loss of files being processed. As a fully integrated on-line system, it provides a single source of data, allows maximum access while optimizing updating capabilities and organizes modules by administrative functions.

ISIS/II meets the functional requirements of each client institution through a series of modular subsystems, each relating to specific administrative needs. As a result, this sophisticated computing resource can act as the official source of student information for use by most administrative services offices, including:

- Admissions, Registration, and Records;
- Advisors and Counselors;
- Accounting and Business Offices;
- Deans, Department/Division Heads and Faculty;
- Financial Aid and Veterans Offices;
- Educational Planning and Research.

Systems & Computer Technology Corporation
Great Valley Corporate Center, Four Country View Road,
Malvern, PA 19355 (215) 647-5930

Minnesota State University System
Project for Automated Library Systems

Dale Carrison
Dean
Library
Mankato State University

Sperry Univac
P. O. Box 500
Blue Bell, PA 19424
(215) 542-3862

Sperry Univac representatives asked Dale Carrison of Mankato State University to make a presentation at CAUSE 82 on Minnesota State University System's Project for Automated Library Systems.

The Minnesota State University System (MSUS) has developed a centralized, automated library network using 144 ADDS Regent-20 terminals and 3 Univac V77-200 terminal concentrators (UTC) to utilize the system's Univac 1100/80A computer. The data base available to the eight participating institutions consists of over 1.3 million bibliographic records on six Univac 8434 disk storage units. Cataloging of all MSUS information resources is done on OCLC, an international cataloging network centered in Dublin, Ohio, and OCLC archival tapes are used for data input.

Card catalogs have been frozen and are no longer updated at the eight participating universities. Faculty and students search for materials by using the terminals located throughout each floor of the libraries. Instructions for the use of the terminals are posted on each terminal. Codes such as AU for author, TI for title, or TE for term are entered by the users who search online for materials. No logon or entrance passwords are required. All terminals await user requests throughout normal library hours. Any bibliography resulting from a search can be printed locally or centrally on demand from the user who types "PRINT."

The software configuration includes the Univac 1100 Operating System, Level 37.R2C; the UTC software for the Univac V77-200, Level 7.62; the Univac 1100 Data Management System (DMS), Level 8R2B, which manipulates 23 library files and related indexes; the Univac 1100 Communication Management System (CMS), Level 7R2B, which interfaces the online terminals and user transaction programs; and the library system program modules written in Univac 1100 ASCII COBOL. The system provides general transaction processing that allows remote terminals to initiate execution of preregistered TIP program modules.

The Univac 1100 is also used for all academic computing within the eight state university systems. The library shares the computer and the communications network that transmits data to and from the remote sites. The communication network consists of one pair of CODEX 6030 statistical multiplexers, ten pair of CODEX 6010 statistical multiplexers, and eleven pair of LSI 9600 baud modems. This network ties the main computer site to the eight different remote sites.

Currently, the system is used for catalog access only. Circulation, acquisitions, and serials control are in development. The library system is currently handling approximately 1,000,000 transactions per month at 1.0 seconds computer time per transaction. A search of the full 1.3 million records takes three seconds on the average.

A statistics module records data on transaction activity, command usage, terminal and institution usage, response time, and processing time. The system is currently using about 12% CPU time and 40% I/O time of the total computer usage.

Early fears about the acceptance of the system were found to be groundless as library users of all ages and education levels readily operated the terminals. After thirty minutes of instruction and use, most people can effectively utilize the system. An explanatory handbook and knowledgeable library personnel are readily available near public service terminals, and an online assistance module called HELP offers assistance. Users have found that the catalog search, by combining and limiting search terms, offers retrieval power not possible through traditional methods. The online catalog is a comprehensive, integrated, information access system with provision for keywork and Boolean searches; format, date, and language limitors; truncation and substitution of ? for unknown letters and words; choice of record displays; access by various identification numbers; multiple institution holdings and displays; index browsing capability; demand and overnight printout provision; and COM catalog and offline special list production. The online catalog software is available through a license agreement.

Public access to online catalogs demonstrates that libraries are embarking on a new era of information access. Expansion of access to many diverse physical locations and by keyword searching enables the library user to more easily find and utilize all formats of information than has been possible in the past. Added information is available and speedily updated for serials holdings and on-order and in-process materials, as well as circulation status for all items in the library's resource collection. Network connections further expand information access. Programmed online instruction gives the user assistance not feasible in the traditional card catalog and offers new opportunities for effective instruction in the access and use of information.

ABSTRACT FOR CAUSE '82 NATIONAL CONFERENCE

Presentor: John W. Gwynn

TITLE: SERIES Z - A New Concept In Managing The Information Resource

One of the main problems in managing the information resource is that management usually does not control the information resource. It is impossible to manage something that is not controlled. As long as management must go outside of its own organizational structure for the processing of its own data then it does not have the control needed for truly effective management of its information resource. We have gone about as far as we can go with the traditional division between providers of information and users of information. Series Z is a software package designed to put the control back in the hands of the end user of the information.

Now it is true that the information resource includes more than a computer system with application programs and a data base. But as a significant component of the information resource, the hardware, software, and data base must be available not only for the production and processing of data but also for the modification of systems and processes. With Series Z, management not only has control of the production and processing of data but also access to the tools needed to modify existing or create new systems and processes.

Series Z is actually four systems in one: Financial Records, Human Resources and Student Information, all pulled together and moved along by the Z Support Software. The three functional systems are fully integrated applications that each operate on a single data base. The Z Support Software provides the data base management, on-line access, and a package of tools such as generalized inquiry and update or a generalized data collect that are easily learned and used by personnel in the administrative office.

Traditional data base management systems were developed independently from any class of applications. On-line was added at a much later date. Application development systems have been drawing a lot of attention in recent months. Applications must somehow utilize this diversity of software products, which were never designed to work together nor provide efficient operation. Series Z, on the other hand, has been carefully designed to be an intelligent synthesis of the best features of a DBMS, on-line, and an applications development system needed to support higher education administrative applications. This highly integrated blend of the best of current technology is the only software that has been designed as a single unit to include the functional application, data base support, on-line support, and application development tools.

In addition to the most comprehensive set of integrated application software available in higher education today, the Series Z Support Software provides:

ABSTRACT FOR CAUSE '82 NATIONAL CONVENTION
John W. Gwynn
SERIES Z - A New Concept In Managing The Information Resource

Security - at three levels: system, screen, and data elements

Help - available at any time without disrupting processing activity, at the touch of a key, at three levels: data element, screen, and error message

Data Base Definition - to define the data base including editing control on every data element

Screen Definition - to easily modify or add new screens

Recovery and Restart - should the hardware fail

Generalized Audit Trail - easily invoked to include any of several levels of recording

Generalized Inquiry and Update - a very special package that permits easy access to and modification of the data base from screens developed by the user without a need for programming

Generalized data collect - for those who want to enter transactions, have them fully edited and batch controlled, and queued for later batch update

Menu Control - to clearly and easily list all available system functions but not requiring menu display to access processes

Process Linking - to provide user defined process sequences

Procedure Definition - to permit user written software to easily fit into the Series Z structure.

Series Z, by Westinghouse Information Systems is a software package that finally makes it possible for management to control its information resource.

BUSINESS AND PLEASURE

Ideas are exchanged as readily during breaks between sessions as they are at formal track presentations. An important part of the Conference experience are the social gatherings — those that are scheduled as official Conference activities as well as those that occur spontaneously as new friendships are formed and old acquaintances are renewed.

CAUSE 82 featured a number of special activities. One out of four conferees participated in the sports activities —a golf tournament, tennis round robin, and mini-marathon. The winners of the events were presented prizes during the Thursday evening banquet and many found themselves stars on the screen when slides were shown of the "sporting" events. These events were made possible by three sustaining member companies: Westinghouse Information Systems (golf); Peat, Marwick, Mitchell & Co. (tennis); and Electronic Data Systems (mini-marathon).

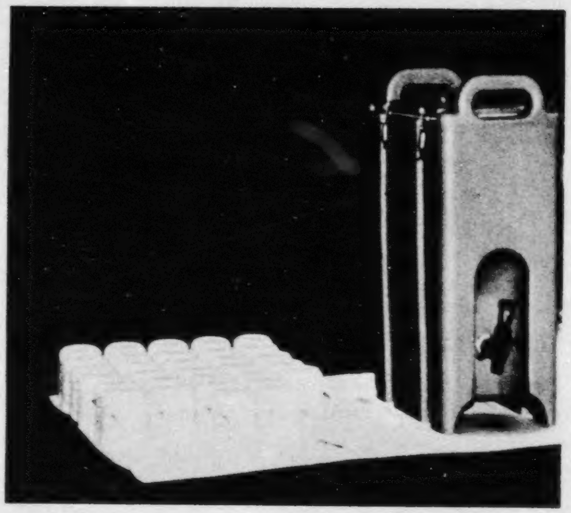
The CAUSE 82 Southern Country Bash was a swinging success. Conferees tapped their toes and kicked up their heels to the sounds of Hand Picked, a five-piece bluegrass/country band.

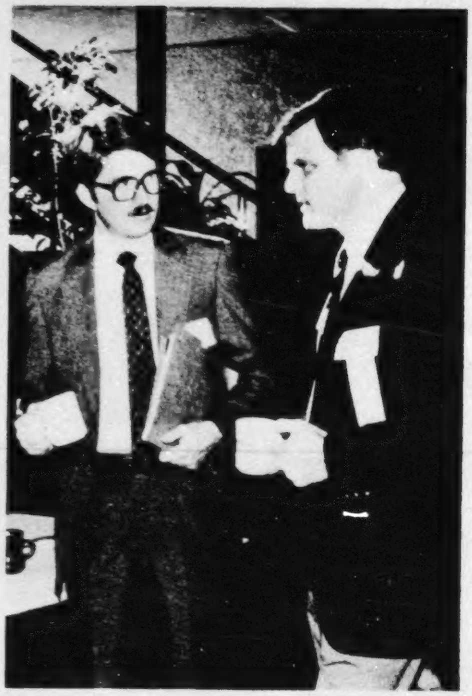
CAUSE 82 Golf Tournament
Sponsored by
JONES
OMENS

CAUSE 82 Tennis Tournament
Sponsored by
Peat, Marwick, Mitchell & Co.

REGISTRATION RECEPTION

REFRESHMENTS

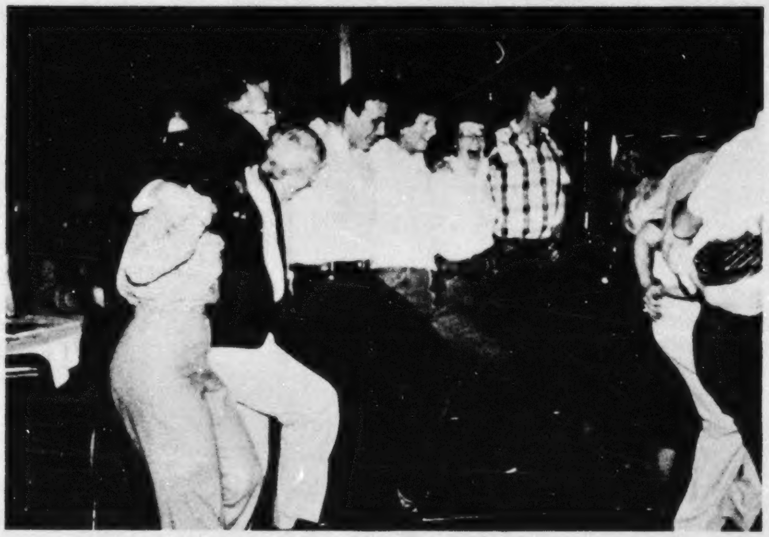




Special thanks to Digital Equipment Corporation for sponsoring the Friday morning refreshments and providing conferees with coffee mugs commemorating CAUSE 82.

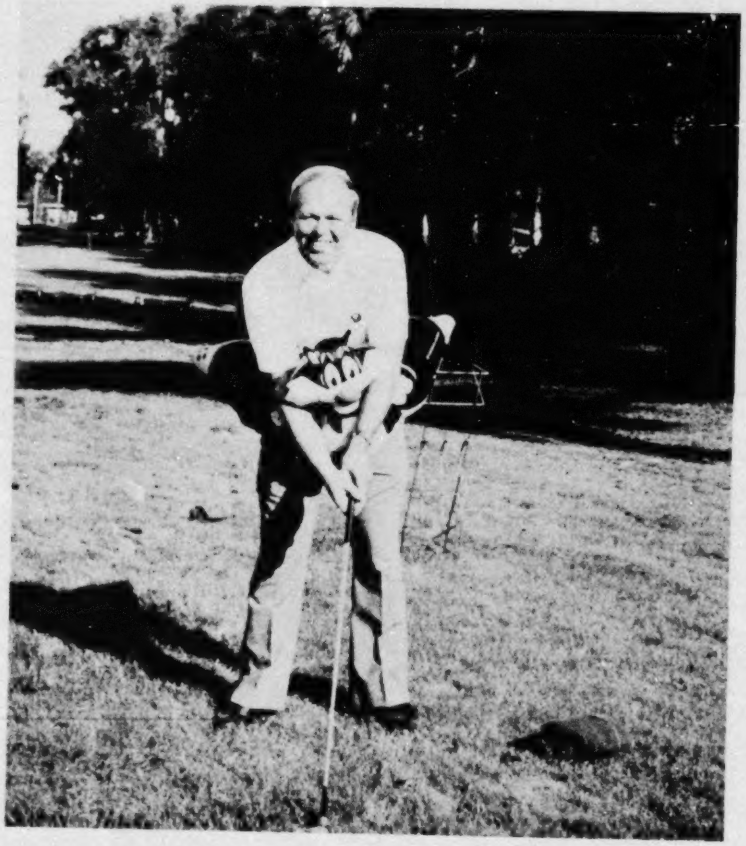
BREAKS

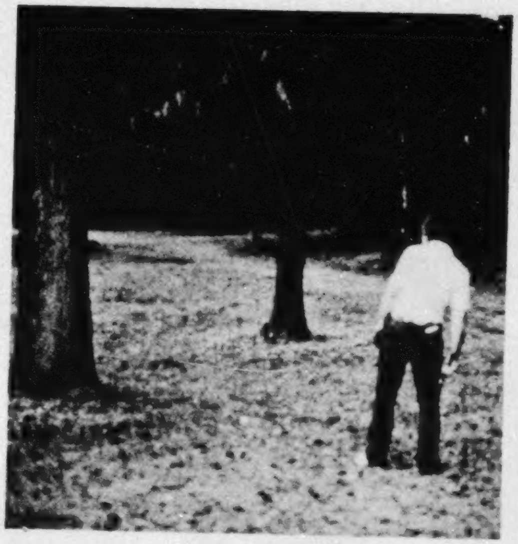
SOUTHERN COUNTRY BASH



THE THRILL OF VICTORY . . .

ROD LAVER FUN





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CAUSE 82

PrecisionVisuals